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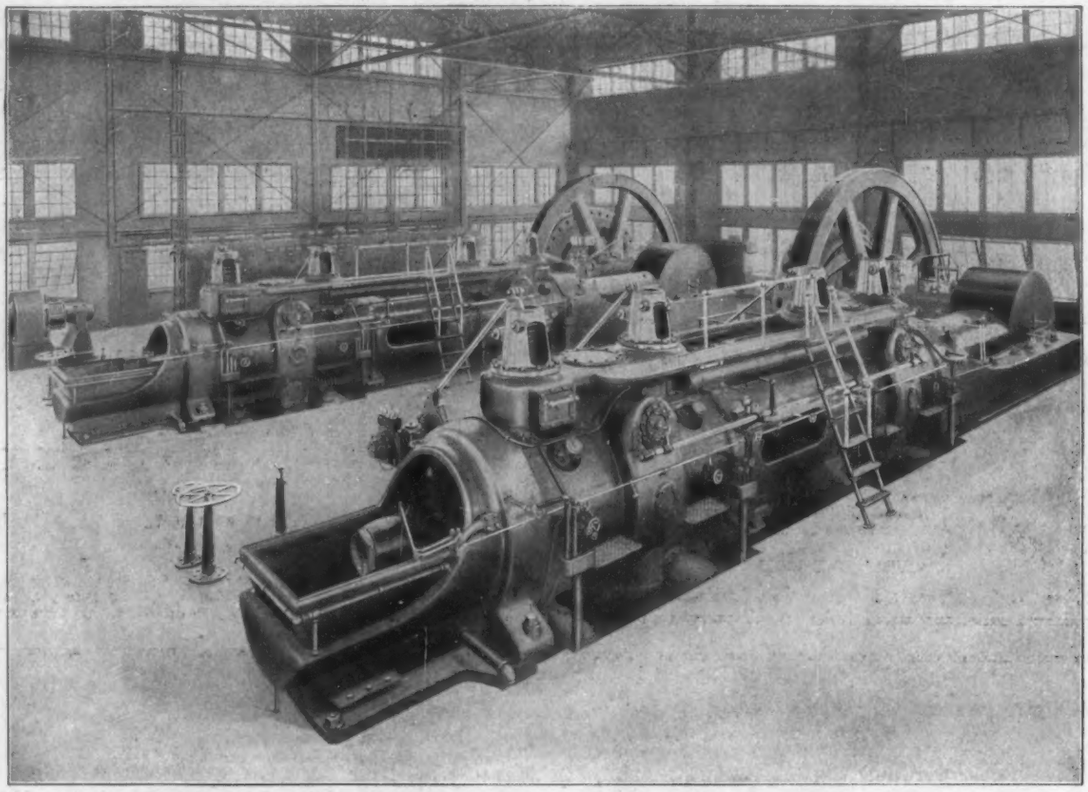

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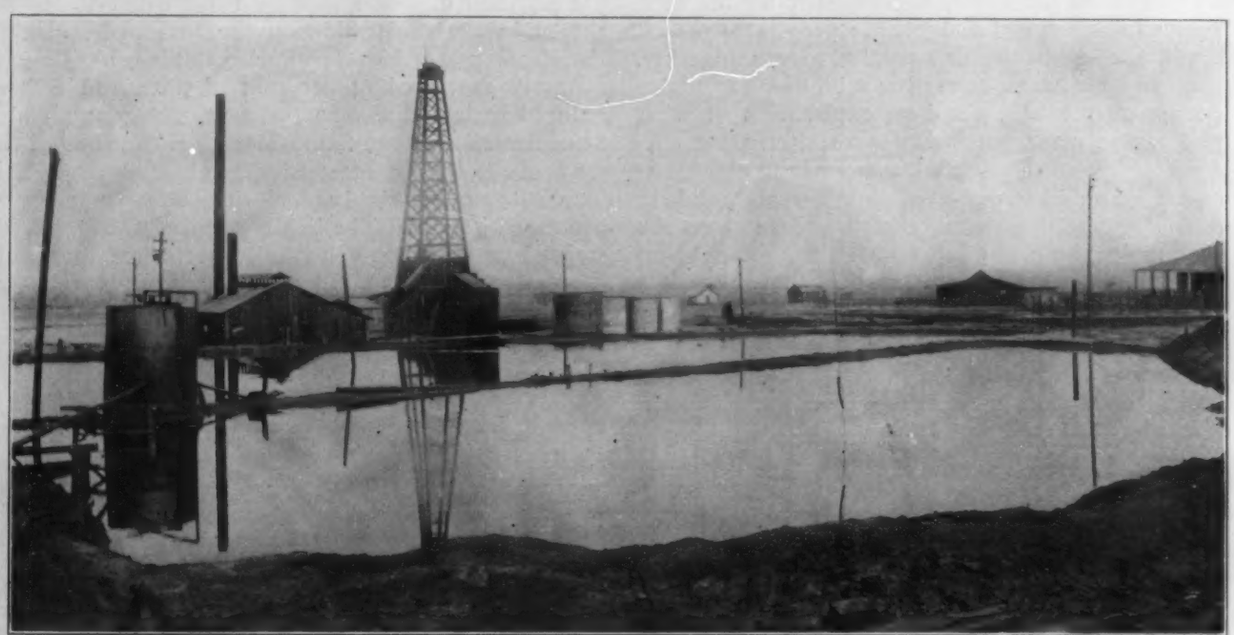
ELECTRICAL DEHYDRATION OF OIL

In many of the oil fields of California there are great pools of oil containing such a large percentage of water as to be unmarketable. This water was usually introduced in pumping and heretofore all attempts to separate it from the oil have failed. Some of these great pools contain hundreds of thousands of gallons of oil that have stood for three or four years. The specifications usually limit the water content to a maximum of two per cent or thereabouts. These emulsions contain all the way from ten to eighty per cent of water and have therefore been practically useless and have constituted one of the greatest economic wastes in the oil industry.

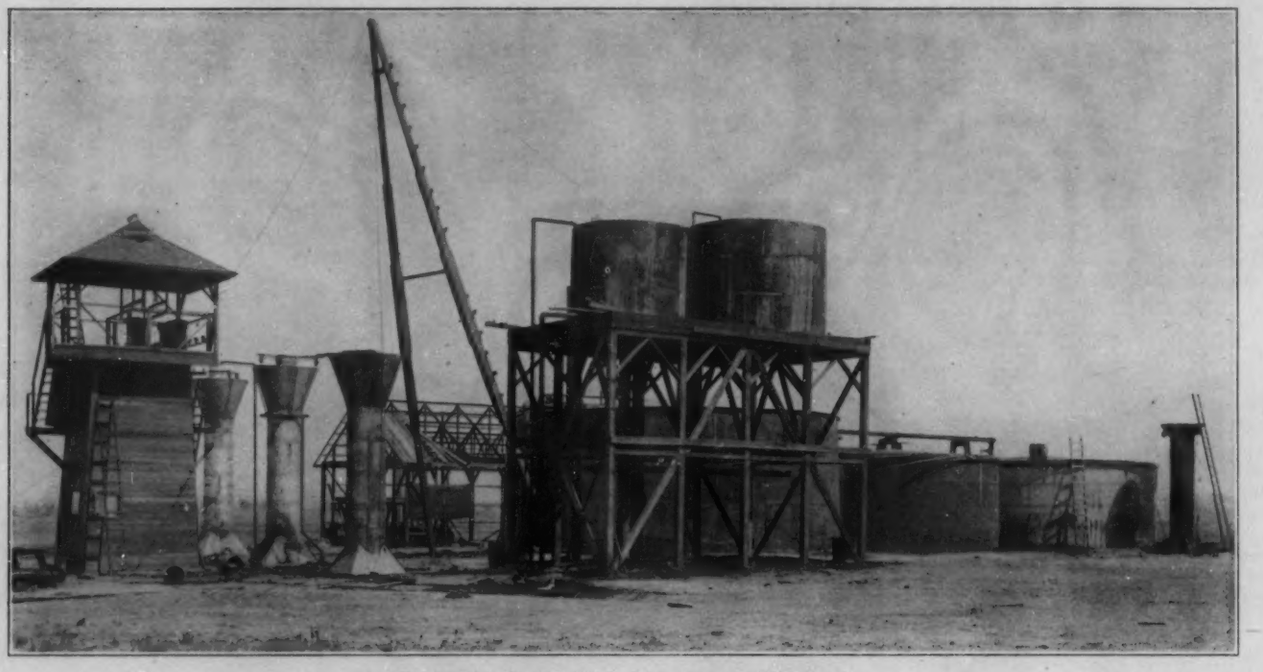
One of these pools which stood for years in the Coalinga district is illustrated on this page. The oil in this lake, however, has since been treated by a new process and it no longer stands. This process is a special application of a method for the electrical precipitation of suspended matter, recently patented by Dr. E. G. Cottrell, professor of physical chemistry at the University of California.

At the meeting of the American Chemical Society in San Francisco, July 12-16, 1910, Dr. Cottrell explained in detail the application of this method to the elimination of the obnoxious gases in smelter smoke, incidentally referring to the further application of the same principles to the dehydration of oil. Through his courtesy and that of his assistant, Mr. Allen G. Wright, we are enabled to present herewith illustrations of the apparatus now being used in the California oil fields. This process, which treats the oil at a cost of about one cent per barrel, should prove a great boon to the oil operators of the State, for it makes salable a former waste product now worth thousands of dollars.



Pool of Waste Oil and Water in Coalinga District.

The material to be treated is an intimate mechanical mixture of oil and water. The water particles are surrounded and held apart by films of oil which are so tenacious that they cannot be separated by mere mechanical agitation. Laboratory experiments show that by subjecting such an emulsion to the influence of a high voltage alternating current, the minute water particles are agglomerated and sink to the bottom of

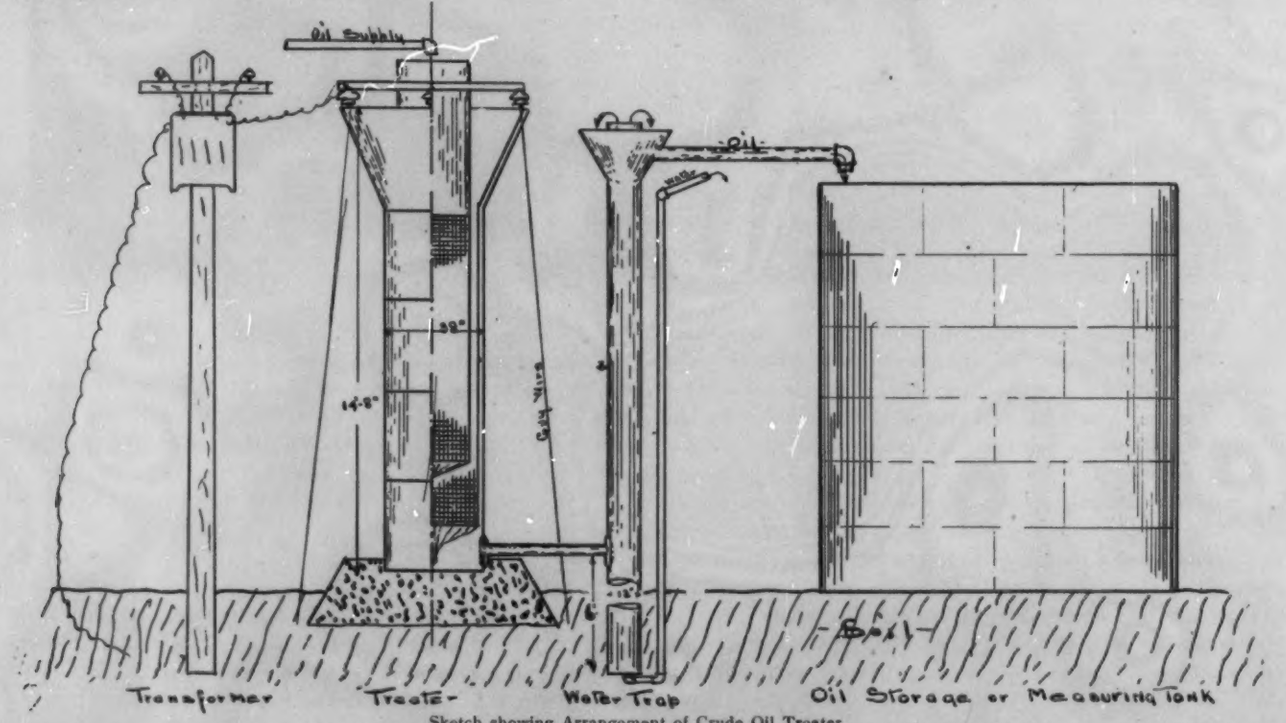


Plant which Treated Oil in Pool shown on First Page.

the containing vessel, being heavier than the oil.

The treating apparatus is essentially a huge Leyden jar whose disruptive discharge penetrates the oil film and allows the water particles to run together. This phenomena was observed in a high power microscope and is probably the best explanation of what actually takes place. In practice an alternating current is stepped up through a transformer to about 10,000 volts. The oil is delivered to the treater, and, as shown by the accompanying sketch, passed on to the storage tanks, the precipitated water being carried off at the bottom. It is an interesting fact that this water is used in preference to the regular supply for washing purposes in the district.

The plant illustrated has a capacity of 500 barrels per day and in a five months' run treated all the oil shown in the illustration on the first page, gaining therefrom 75,000 barrels of marketable oil. This oil formerly contained 14 per cent of water, which was reduced to less than two per cent. A plant is also being installed in the Santa Maria fields at one of the wells of the Pacific Coast Limited Oil Company. This handles 1000 barrels daily of oil containing about 25 per cent of water. The line current at 22,000 volts is stepped up to 10,000 volts and experiments show that it requires about 1-7 of a kilowatt hour per barrel of oil treated. It is expected to further reduce this consumption by use of a rotating electrode.



Sketch showing Arrangement of Crude Oil Treater.

THE CHURCH AND TECHNICAL EDUCATION.[1]

BY G. W. DICKIE.

What has the church to do with technical education? Certainly in the past the protestant church has had little connection with the technical training of its own people. I sometimes think that in this statement is expressed the reason why such a large proportion of the technical men of this generation are outside the church.

It is only within the last fifty years that technical knowledge has become of necessity a distinctive feature of modern education. The accumulation of experience in dealing with the forces of nature is one of the characteristic distinctions between man and all other created beings. This faculty endows him with a power which has been given him not that he might be independent of God's revealed will, but that he might be able thereby to help in the working out of that will and thus become an intelligent and efficient agent in the consummation of the grandest and most beneficent purposes of the Creator.

The knowledge of nature's laws which Christian men call God's laws is a branch of education that the church cannot afford to neglect. Perhaps no branch of human knowledge needs the influence of the church more than does technical education. It deals with material things; it needs protection from materialist tendencies.

Imparted at a time when the mind of youth is in its most receptive state, technical education, dealing with the material universe and its utilization, tends to crowd out the spiritual, and unless the mind is taught at the same time to refresh its power in the contemplation of the infinite, the man will be developed simply as a worker among the forces of nature. He will hear no music in the waterfall except the din of wheels that he can make it set in motion; he will see no grandeur in the thunder cloud or lightning flash except the visible evidence of a power that is everywhere, that he has found how to condense and transform into a means of transmitting his thoughts to the farthest parts of the world, that he can carry to the cities to make them brilliant with light and vibrant with power.

Can the churches that are supposed to be the central stations of spiritual power afford to see the best mental material of the new generations turned away from all religious influence and devoted entirely to the application of natural forces to the satisfaction of the physical wants of mankind? I think not. That she may combine with technical training that moral and spiritual teaching which will prevent the pupil from degenerating into a mere adapter of nature's laws to some end in view, that she may help develop him into a man with nature as his instrument and the God of nature as the supreme power of his life, is why the church is vitally interested in technical education.

The reason why the spirit that animates the church that teaches the meaning of the spiritual laws of God's universe should be the same spirit that animates the institution, wherever it may be, that proposes to teach the meaning of the natural laws that govern the material universe, is that the spiritual and the natural laws are ultimately the same, originating in the same lawgiver, and that life which is not lived in accordance with both is incomplete. They differ in this, that the knowledge of nature's laws comes to us by the exercise of those faculties with which we are endowed, while our knowledge of spiritual laws comes by acceptance, by revelation. The essentials of religion cannot be cultivated like other branches of human knowledge and experience. Religion is not a progression of accumulated facts, one leading into another as one proposition in geometry follows out of another, making a progressive science gradually built up and acquiring greater scope.

High as man is placed above the things and creatures around him, there is a higher, a more exalted position within his vision. The ways are infinite in which he occupies his thoughts in regard to the fears, the hopes, and the expectations of a future life. Now, I believe that the truth relative to that future cannot be brought to his knowledge by any cultivation of his mental powers, however well he may be endowed in that way. Such knowledge, if it comes to him at all, will come through other teaching than his own and will have to be received through simple belief in the testimony given.

I would not have you suppose for a moment that the self-culture I have so often recommended in respect to the things of this life, can be extended to embrace the essentials of religion, as if a man by reasoning could find God. I must therefore claim an absolute distinction in this respect between the essentials of religion and the essentials of human sciences or mental cultures. I might be reproached with weakness, if nothing worse, by refusing to apply those mental operations which I think good in respect to high things, to the very highest things. I am quite content to bear any such reproach. I have never seen anything incompatible between those things which can be known and demonstrated by the mental powers with which man is endowed and those higher things concerning his eternal future, that he cannot find out by any exercise or culture of those faculties and which he must accept as a child does an inheritance.

The church has not been alive to the need of technical education to deepen and brighten the teaching of its great and universal text book. Under her guidance, a new order of manhood might be produced who would know and feel that—,

"To matter and to force the all is not confined.
Beside the law of things is placed the law of mind.
One speaks of rock and star and one within the main,
In unison at times and then apart again,
But tell of one who brought us thither
And holds the key of whence and whither.
The sequence of law we learn through mind alone.
We see but outward forms, the soul the one thing knows,
If she speaks truth at all the voices must be true
That give to visible things their laws and honor due
But tell of one who brought us hither
And holds the key of whence and whither.
God in his science tells what no known laws foretell,
The wandering stars and fixed alike are miracle,
The common death for all the life renewed above,
Are both within the plan of that all circling love.
The seeming chance that brought us hither
Accomplishes his whence and whither."

1 Lecture delivered in a San Francisco Church.

What we need in our technical schools of to-day is a recognition of the spiritual needs of the scholar. When these needs are felt we will have reverent students of God's universe and that will bring into the profession nobler characters and into the church a strength that will enable her to accomplish the great work of which she is now only beginning to see the possibility.

We ought in our search through the treasure house of nature to be lead by the "Pillar of cloud by day and the pillar of fire by night," as surely as the old Hebrew emigrants from Egypt were, if we are ever to reach our promised land. That old story tells us that the Lord went before by day in a pillar of cloud to lead them on their way, and by night in a pillar of fire to give them light to go by night as well as by day. "He took not away the pillar of cloud by day nor the pillar of fire by night from before the people." That has always been a fascinating wonder to me, and looking back upon the twilight wonders of this old record I find that the most remarkable fact in the experience of these ancient emigrants was undoubtedly that God Himself went before them in this visible way. I can imagine the awe with which they looked upon what they believed the visible presence of God and what an interest they would feel in that wonderful cloud. I have often pictured that occasion when "The cloudy pillar descended and stood at the door of the tabernacle and talked with Moses, and all the people saw the cloudy pillar stand at the tabernacle door; and all the people rose up and worshiped, every man in his tent door; and the Lord spake unto Moses face to face as a man speaketh to his friend."

It is not necessary for my present purpose, which is not that of merely preaching a sermon, to separate that which is spiritual from that which is material in this wonderful manifestation to those Hebrew emigrants. The spiritual part of it is represented in the history of every true man who is lead, often by devious wanderings, for some forty years or more through a wilderness of varied experiences till he comes at last to the waters of Jordan. He has had realizations of the presence of God in the daytime of his life experience when he could almost see the cloudy pillar leading the way, though he could not understand the mystery of it—a cloud that joined earth and heaven. Then in the dark days of his experience and night times of ignorance and helpless inability his idea of God is not that of the cloud, but something more vivid—a fire giving light, but inapproachable—a consuming fire. This story is ever true in man's mental and spiritual experience.

If you want your young man to know something of the material realization of this cloud, show him our great ocean greyhounds which are carrying nations of emigrants across great sea deserts from old homes to new lands of promise. Have they not their cloudy pillar by day and their pillars of fire by night continually ascending that they may go by day and by night? In that cloud also God has a material presence that can be realized by those who are searching for Him, and it is the business of the church to teach the ear to hear and listen to the voice that comes from that cloud—for he who so listens will not fail to recognize that voice to be "The voice of the Lord speaking face to face as a man would unto his friend." It is that those who come to know of the nature of this material cloudy pillar may also learn to know and feel something of the living presence of the God of nature, that the technical schools need the support and guiding hand of the church.

The earnest, thoughtful student, as he comes near to this cloudy pillar will hear a voice speaking to him just as distinctly as Moses heard it. The voice of the cloud will tell him of a time in the distant past, millions of years before there was a man on the earth, when he had a friend working for him, the same friend who speaks from the cloudy pillar; that he anticipated the coming of man, who should be his heir upon the earth and should bear his likeness; and provided everything necessary to maintain that dignity. These things were laid up for him in deep storehouses that some day he would, by the key of knowledge, be able to open, and find material force and power, petrified into preserved blocks of almightyness. When he learned to bore through the rocks he would find liquid power, the possession of which would make him mighty beyond all creatures of the earth. He also learned something of the ways of this great friend whose voice is in the cloud, this grand past master of all nature's laws and of all sciences; something of how he carried out this design for his future friend by planting immense forests of gigantic pine and tree fern, and forced their growth by making conditions of heat and moisture more favorable to vegetation than any that have since existed. Then he let torrents of mighty rivers break from their ice-bound channels and hydraulicked out those mighty forest giants, carrying their huge trunks down the water courses to be entangled in the jungle growth he had prepared at the river mouths. These in the course of time he submerged, to be silted over with rock worn soil of ages. Then he lifted them up and repeated the forest and its destruction. This process he enacted again and again, concluding by putting the pressure of worn-down mountains upon the huge mass, holding it there for ages until the great forests, the peat mosses and the jungle were changed into hard black coal. At the same time he was working in his great laboratory condensing hydro-carbon gases from the by-products of his great operations and collecting them in rock-bound cisterns, where they have been held captive for ages, until his friend man found out how to uncork them and let this concentrated power gush out. Think what condensed power is in the coal beds and what sealed-up dominion is in the oil cisterns. Consider the mighty things that are being accomplished around the million altars whence continually ascend these modern cloudy pillars.

Consider our locomotion by sea, on the earth, and in the air. Are we to teach our youth that because we have discovered the combination of the lock that has kept this great power from men of past generations, these treasures are ours? It is not so. Our friend who speaks from the cloud says to us in reference to these modern wonders of locomotion, just as he spoke to the old Hebrew pilgrims, "I bore you on eagles' wings and brought you unto myself; now therefore, if you will obey my voice, indeed, and keep my

covenant, then you shall be a priceless treasure unto me above all people, for all the earth is mine." What was the crossing of the Red Sea on foot compared to our modern miracles? Surely with far more emphasis can the phrase "I bore you on eagles' wings" be applied to our modern experience, to the civilized nations of the earth, and especially to those who have the power of eagles' wings, which are now an accomplished fact through the instrumentality of liquid fuel and the internal combustion motor. It may, I think, be inferred with equal surety that the reason or purpose of His having put all this power in our hands is as He has said of the ancient "chosen people," that He might bring us unto Himself to be a peculiar treasure unto Him above all people, for all the earth is His, all the nations of the earth are His treasures, and they who obey His voice are His peculiar treasure.

We must teach our youth to believe in miracle and to recognize the miracles of our time in their true magnitude. The ancients of every nation, especially those through whom we have the Bible, delighted to throw up to the surface of their records the golden weft of miracle that, crossing the warp of fact, makes up in every age the web of history. In our age we do all we can to hide the weft thread which is in the web and throw to the surface only the pile of the straight, natural warp. This is surely an error, for it hides from us much that is beautiful and inspiring around us and that was undoubtedly meant for the gratification of the highest functions of our spiritual natures. This has led us in our pride to judge the ancient races of man by the same standard we set up for ourselves, so that we often seek to accept as matters of sober fact what they have worked into their records as figures of speech and poetical imagery. Much that we are told in the Bible of the Hebrew people may be the story of historical and noble deeds sung at times into the poetry of miracle. For instance, Moses appears before Pharaoh with a petition written by his friend Aaron on a scroll of papyrus wound upon a staff or rod. He lays this before the monarch, demanding at the same time the liberation of his people. He has cast his rod before Pharaoh, who is stung to the quick, as we would say. Moses says the rod became a serpent. The king calls a council of his wise men and each of them prepares an answer and presents his scroll wound upon a rod. None of them can withstand the force of Moses' argument and the result is thus described: "They cast down every man his rod and they became serpents, but Aaron's rod swallowed up their rods."

Let me now, with a little of the spirit shown by this ancient people, which is the spirit which should animate the teaching of every technical school, search in this modern cloudy pillar for those golden threads of miracle that are there, as in every object of nature interwoven with purely material substance.

The object of the "Pillar of cloud" and the "Pillar of fire" was that the people might go by day and by night. They could not do that long, for they were often in need of rest. Our pillar of cloud is raised also that people may go by day and by night, but without effort on their part and even while they rest, for their floating tabernacles, or rolling cars, and soon, possibly, flying carriages, are pitched on eagles' wings. While the sleeping pilgrim crossing the ocean desert draws one breath he and his couch are borne a distance of two hundred feet through ocean billows split by an iron wedge twenty thousand tons in weight, whose speed exceeds two thousand feet per minute. Whence comes this miracle of power? What is the secret of that altar service whose incense is the "Pillar of Cloud"? That which propels the great steamship on the sea, the trains on land, the automobile on streets and roads, the car on wings that cleaves the air, which pumps and grinds and spins and weaves, and by the spirit of fire and water everywhere makes man omnipotent, is the power of combustion in the material world and sacrifice in the spiritual world.

Consider the smokestack of the ocean liner. It is fifteen feet in diameter. Every minute ten tons of burnt fuel—coal and air—pours from it with a velocity of one thousand feet per minute. It seems impossible that any steamer could carry such a large quantity of fuel as to allow of her burning ten tons per minute. It is not carried. Our friend who speaks from this cloud separated the materials of combustion for us millions of years ago and laid up for us only the essence of fuel. Only five per cent of the total weight of the fuel has thus been preserved, and this much alone has to be carried for fuel in the form of coal or oil. The other ninety-five per cent of the fuel is delivered free on board by our friend who speaks from the cloud without freight or cost at any part of the ocean. The steamship at sea or the locomotive on the land does not need to stop or slow down to take it on board and the finest dress of any of the lady passengers will not be soiled by its dust. It comes on board in the form of pure fresh air, finding its way down the hatches and ventilators to the fire room without any direction or assistance, although it has never been on board the vessel before, and in about ten seconds of time it is out again at the top of the smokestack. It has done its work like all the work that is done for our friend of the cloud—quietly and well.

A divorce effected millions of years ago between carbon and oxygen has in these few seconds been cancelled and the parties have been reunited and are now rushing out on their marriage trip with a speed of a thousand feet a minute. Not very like a wedding you will say, judging from the hue of the procession. They have simply donned their traveling robes. Their gay trousseau is all packed. But they have with them all the bright hues admired by the ladies of to-day. All the colors of the beautiful flowers, plants and trees are there hidden from sight for a time. Some day when you are admiring the beautiful colors of some radiant blossom think how it may once have been an atom of smut in the curling cloud above some factory chimney. This is a miracle. You may have seen a brass founder stirring among a heap of brass chips and dust with a magnet to find the little bits of iron that may be hidden in the brass. In this way the myriads of green leaves in every forest and field are waving like magnet searchers in the atmosphere, fishing, as it were, for the molecules of carbonic acid gas, and when one of these comes along out of some pillar of cloud perhaps many miles away, it is seized by the living leaf. Leaves are the opposite of our boiler furnaces. The leaves seek carbon, not oxygen, from the air. Each leaf holds up its captive atom to the

sun and from that origin of power, the same friend who speaks to us from the cloud, using as his instrument a ray of light ninety-five millions of miles in length, picks out the oxygen from the carbon in each molecule of gas, liberates the oxygen for the health and comfort of man, and imprisons the carbon for the health and beauty of the plant. Here is a wonder miracle, something that man has been unable to accomplish in any instance by all his laboratory contrivances or electric currents. He has not succeeded in separating one molecule of carbonic acid gas into its constituent atoms—carbon and oxygen.

Now, when we consider that not only our happiness, but our very life, depends on this separation being effected, and that our friend who speaks to us from the smoke cloud alone can do it, and that He is continually at work operating with millions and millions of needles of light each ninety-five millions of miles long, picking these carbonic acid knots for us with one hand while with the other He keeps turning the world round to bring successively every leaf of every plant on the surface of the earth under the points of these magic sunbeam needles, do we not feel ready to acknowledge the miracle and to think that if we are to cast off our shoes wherever there is holy ground we should never have shoes on our feet again, for His presence sanctifies all work and every spot. "Canst thou by searching find out God, canst thou find out the Almighty unto perfection?"

Searching in the smoke we have found the seams of coal, the oil deposits and the forests of a hundred ages ago dove-tailing with a nice fit into the atmosphere of to-day and every leaf on forest and field dove-tailing into the atmosphere, and man with his busy hand and brain dove-tailing into them all. We have been searching for the Almighty. We hold up as much of one of his puzzles as our limited skill has enabled us to put together and looking at it say, "Lo, these are parts of His ways, but how little a portion is heard of Him. But the thunder of His power who can understand."

It is, I think, to be concluded from any careful investigation into the correlation of the material and the spiritual, that we reverently bring our youth from the sanctuaries of His spiritual presence to the portals of that great temple where He speaks to those who desire to hear Him through the medium of the material world in which we live and do the work He has given us to do.

Examination for first-class steam engineer is announced by the United States Civil Service Commission on August 10, 1910, to fill a vacancy in the position of chief engineer, $1600 per annum, in the United States Postoffice, Custom House, and Court House Building at Cleveland, Ohic

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Examination for second-class steam engineer is announced by the United States Civil Service Commission on August 10, 1910, at the places mentioned in the list printed hereon, to secure eligibles from which to make certification to fill two vacancies in the position of assistant engineer, $1200 per annum each, in the United States Postoffice, Custom House, and Court House Building at Cleveland, Ohio.

HISTORY OF GAS LIGHTING IN MARYSVILLE.

BY E. C. JONES.

E. C. Jones.

Marysville, named in honor of Mary Murphy, one of the few survivors of the ill-fated Donner party that arrived in California in 1846, was the third place in California to introduce illuminating gas. During the pioneer mining days Marysville was one of the most important towns in California. It is situated almost at the geographical center of the Sacramento valley, on the east bank of the Sacramento river, near the confluence of the Yuba and Feather rivers. Because of its location it was the natural source of supply for the miners early operating along the Yuba and Feather rivers. The large population and the richness of its tributary mining district established Marysville as a town of importance.

When red-shirted miners by the thousands were working in the placer diggings in the foothills to the eastward, Marysville was a big place with a population as great half a century ago as its 5000 of today.

It is a flat town, protected along its river side by a 20-foot embankment to ward off the menace of high water during the rainy season.

First Marysville was all for the miners, but when mining began settling to a system of fewer individuals and more machinery, and agriculture grew to be a greater and greater prospect in California, then Marysville became the storm center of that historic legal struggle between the hydraulic miners in the foothills and the farmers in the valleys, where the navigable streams were being slowly but surely made shallower and shallower by torrents of mud from the hydraulic mines. Marysville found herself in the middle of a rich, level, agricultural area of vast proportions.

The farmers were becoming more numerous than the miners, and they were doubly interested in preserving the depth of the river channels, because of the commercial advantage of having water transportation to compete with railroad rates and because of the necessity of maintaining a channel of sufficient depth to avoid the certainty of ruinous inundation by high waters and the covering of the adjacent farming lands with a deposit of "slickens" from the mining regions.

Today Marysville is an old town still young. The buildings in its business section and some of its sidewalk signs proclaim an origin dating back half a century, and the styles, created when miners' money was dominant, have not been changed much, though Marysville has become a commercial center of farms and orchards, and has within its own limits machine shops, foundries, sash and door factories, flour mills, woolen mills and canneries.

In 1857, the success of gas making in San Francisco and Sacramento having been assured, proposals were made to the common council of Marysville relative to lighting the city with gas. Charles H. Simpkins, a prominent citizen of the place, and A. F. Williams, who had been well and favorably known in connection with water ditches in northern California, made a proposal to furnish Marysville with gas and water. Proposals were also made by Tiffany and Wethered

of San Francisco, and by Dr. Teegarden of Marysville and David E. Knight, who was then connected with the gas works in Sacramento.

May 22, 1858, the Marysville Goal Gas Company was incorporated by David Edgar Knight, Charles H. Simpkins and Adoniram Pierce, with a capital stock of $50,000. This was subsequently increased to $100,000. May 10, 1858, the right to lay pipes through the streets of Marysville for the purpose of distributing gas was granted to D. E. Knight & Co. In exchange for the privilege the company agreed to furnish free gas for lighting public buildings so long as no franchise was granted to any other gas company. Thus was the original company safe-guarded against competition. The work of constructing the gas plants was personally supervised by Knight, Simpkins, and Pierce.

Gas was first manufactured in Marysville August 18, 1858, and sold for $12.50 a thousand cubic feet. The works consisted of two benches of 3's, iron retorts in what was known as the H setting. The retort house

Original 20,000-Foot Gas Holder, With Glimpse of Knight Residence.

was a small, brick, flat-roofed warehouse, and the capacity of the works was 18,000 cubic feet in twenty-four hours. The flat roof of the retort house was found convenient as a scaffold while cleaning out stopped stand pipes through holes in the roof. The condenser consisted of a 3-inch, cast-iron, return pipe located in the coal shed. Two wooden casks, one above the other, served the purpose of the washer and scrubber. The purifiers were made of wood, and hydrate of lime was used on perforated, sheet-iron trays. A 3-foot station motor completed the sequence of apparatus up to a 20,000-cubic-foot gas holder.

In 1860 the distributing system consisted of 14,550 feet of mains, from which were served 200 consumers. The average output of gas was 200,000 cubic feet a month. The first reduction in price was made December 16, 1860, in response to a public petition. A system of discounts was established, 10 per cent being allowed on consumption of more than 200 and less than 1000 cubic feet a week, and 15 per cent discount on all gas consumed amounting to more than 1000 cubic feet a week.

In 1862 a uniform price was established of $10.50 a thousand. In the spring of 1867 the works was reconstructed on the original location.

The iron work, including the gas holder for reconstructing the gas works, was shipped from Philadelphia on the clipper ship "Old Hickory" some time during 1866. The ship was 356 days on the voyage, and was given up by the underwriters as lost. The owners did not lose their ship, but the captain lost his commission as her master.

During 1867 a voluntary reduction to $9 a thousand was made in the price of gas. From the beginning of this industry in Marysville gas was made entirely from Cannel coal from Scotland, Ireland, New Brunswick and Australia, sacked in gunny sacks in San Francisco and reshipped by river steamer to Marysville. Old timers in the gas business will remember the names of Boghead, Ince Hall, Lesmahoga, and Albertite, as well as Australian shale. The price of this coal ranged from $25 to $50 a ton. Excessive freights did not warrant the use of low-grade coal in the interior towns of California, as the rate from San Francisco to Marysville, together with drayage, was in excess of the rate by ship round Cape Horn. Castor beans, rosin, wool waste, and pitch pine were also used from time to time to assist in making gas. Lime was hauled in half-barrel rawhide baskets from Cave City, and delivered in Marysville at $2 a basket.

The fire brick used in the construction of the benches were shipped from the east, packed in straw in crates, and cost $125 a thousand. But there were some consoling features in the business, as coke sold for one cent a pound (unscreened) and tar brought $7.50 a barrel, the purchaser furnishing the barrel.

There was no competition until 1886, when an electric light plant was established. But it was not until late in 1898 that a rival gas company came into the field, with a water-gas plant having a capacity of 3000 cubic feet an hour. March 1, 1899, after competition lasting just four months, the two gas companies became merged under the new title of the Marysville Gas and Electric Company. The consolidation of the companies marked the beginning of a new era in selling gas in Marysville.

A further reduction in rates and persistent missionary work resulted in placing Marysville in the front rank as a gas-consuming town. In 1896 there were only six places in Marysville using gas for fuel. In less than six years more than 300 gas stoves were installed in Marysville homes. Today gas is generally used there as a kitchen fuel and for heating.

The water gas sets installed in 1898 were displaced September 1, 1901, by a Lowe, crude-oil, water-gas set, having a capacity of 90,000 cubic feet every twenty-four hours.

Since the consolidation of the rival gas companies, eleven years ago, all the gas used in Marysville has been made at the works near the levee, adjoining the electric substation of the Pacific Gas and Electric Company. At this works there is a 20,000-cubic-foot storage holder, installed in 1898, and a 20,000-cubic-foot relief holder. There has also been recently installed a 175,000-cubic-foot, crude-oil gas set. Pipes to the original gas works connect with and make use of the old 20,000-cubic-foot holder that came "round the horn."

Nearly every new enterprise is stamped at the beginning with the personality of some one man. Marysville's gas business was the creation of David

E. Knight. He was a remarkable man in his town. He had been a plumber, a copper-worker, a cobbler. Then began his time of bigger undertakings. He established the first horse-car line between Marysville and Yuba City, and was president of the company; he owned the race track; he started the first steam laundry, situated where the old Columbia Hotel now stands; he was one of the three owners of the Marysville Foundry; he was president and manager of the Marysville Woolen Mills; and was president and manager of the Marysville Gas and Electric Company. The Sacramento river boats "Knight No. 1" and "Knight No. 2" were named after him. When he died, January 5, 1900, the board of supervisors, of which he was a member, published in memoriam an expression declaring: "He was a pioneer citizen of our state, and one of that sturdy type of men who have builded so truly, so permanently, and so splendidly the social and industrial structure of California statehood. As a citizen he was enterprising, progressive, and judicious. His life was full of substantial accomplishments marked by uniform justice during its course and by a beautiful charity at its close. As a member of this board he was constant in his attention to duty, liberal in his policy, and wise and just in his counsel. His loss to us can not well be replaced, and we deem it a privilege to make here this acknowledgement of his worth and to pay this tribute to his memory.

Such was the man who established the Marysville gas business now owned by the Pacific Gas and Electric Company.

There is a little old one-story brick building at the corner of Second and B streets in Marysville. That was the original gas works. The front end of it is now used as the Marysville office of the Pacific Gas and Electric Company. At the corner of the curb on two sides of the street, half buried in the earth, are two of the original cast-iron retorts used in the first manufacture of gas in Marysville. They serve now to protect the sidewalk from the encroachment of wheels of passing vehicles. Just back of this old building, looming big and red amid shade trees and huge old fig trees, is the former home of David E. Knight.

The writer in preparing this article has drawn freely from an excellent historical sketch entitled "Auld Lang Syne" by T. R. Parker of Napa, who was an associate and warm friend of David E. Knight, and was superintendent of the Marysville Gas Works from 1862 to 1867.

PUBLIC CONTROL OF POWER SECURITIES AND RATES.[1]

BY F. P. ROYCE.

The position taken by some of the state commissions on the questions of public policy involved in the determination of fair rates and issue of securities is of interest. In Massachusetts the Board of Gas and Electric Light Commissioners appointed in 1885 were at that time given the right to supervise rates, and in 1894 were given the power to control issues of stock and bonds. They have from the first taken the position that no company should have outstanding permanent securities representing more than the fair structural valuation of the property without allowance for working capital or for the value of the "going business," except that in connection with the organization of a few new companies they have made a small allowance for working capital. The result has been that in numerous instances they have refused to authorize issues of securities in whole or in part because the companies in question have suffered some impairment of their assets, due either to depreciation which had not been provided for by the company, or perhaps to changes in the art which have made it necessary to buy new equipment in the place of old. In such instances the companies in question have been obliged to make up the deficit due to impairment of assets out of their earnings before new securities can be issued for further requirements.

On the other hand the commissions in New York and Wisconsin have not thought it necessary to inquire into the capitalization of the companies outstanding at the time of the appointment of the commission and have only considered the question as to whether or not the proposed extensions of capital were necessary for the requirements of the business. Under the Massachusetts law, as stated, the Board of Gas and Electric Light Commissioners and the Board of Railroad Commissioners have the right to determine the price at which additional stock may be issued. Until within a year or two, the price so fixed was the fair value of the stock "taking into consideration the market value and other pertinent conditions." The laws have now been changed so that stock may be issued at a price to be determined by the directors, provided the commission decide that it is not too low to be compatible with the public interests. These laws were intended to prevent stock watering or to prevent a stockholder gaining a material advantage in case the stock of his company was selling at a substantial premium by being able to buy additional stock at par. It may be questioned, however, if the operation of the law has worked to the best interests either of the stockholder or the public. The result has been that for most companies there has been in fact a steadily increasing par value of the stock as determined by the commissioners, and if, for instance, a new issue has been authorized at $180 or $200 per share, the effect has been to place that par value on all stock previously issued. The law of the state in providing that new issues of stock should be sold at approximately their market value, has prevented stockholders from getting a large profit by the purchase of new stock at par which would at the time command a higher price on the market; but, on the other hand, whenever new stock has been authorized at a price higher than that of previous issues the effect has been to virtually ratify the market price on all the old stock at the time outstanding. This has actually created a greater inflation than would have been caused by granting authority to issue new stock at par.

Undoubtedly these conditions will be more clearly understood as time goes on and the commissions will be able to formulate definite policies, which on the one hand will assure the customer fair prices with good service and on the other will treat the companies with proper liberality so that the capital without which they cannot be developed wil lbe furnihsed by conservative investors.

[1]Extract from an address before the Graduate School of Harvard University on May 16, 1910.

CALIFORNIA FUEL OIL.

Gas Analysis

(Continued.)

BY R. F. CHEVALIER.

Reagents.

The reagents used are as follows:

For carbon dioxide (CO_2), potassium hydrate solution (caustic potash); for oxygen (O), potassium pyrogallate solution or phosphorus; for carbon monoxide (CO), cuprous chloride solution.

Potassium Hydrate (caustic potash).—500 grams of the commercial hydrate (caustic potash) is dissolved in one litre of water; or, one part by weight of caustic potash is dissolved in two parts by weight of water. Absorption capacity, 1 cc absorbs 40 cc of CO_2.

Potassium Pyrogallate.—Dissolve five grams of solid pyrogallic acid in 100 cc of potassium hydrate solution made by dissolving 120 grams of caustic potash in 100 cc of water. Caustic potash purified with alcohol should not be used or erroneous results will be obtained. Absorption capacity, 1 cc absorbs 2 cc of oyygen.

Phosphorus is a convenient absorbent for oxygen. It should be handled very carefully, as it is highly inflammable. It is used in the solid form in sticks about ¼ inch in diameter and three or four inches long. It must be kept and handled under water. There are occasions when the Orsat apparatus is used in places where the temperature is high; in this case, phosphorous should not be used, as it melts at a low temperature (112° F.) and will form in a solid lump at the bottom of the pipette, choking the connecting U tube. For the absorption of oxygen, the gas is passed into the pipette containing the phosphorous and kept in contact with it from three to five minutes. Phosphorous will remain serviceable for a long period.

Cuprous Chloride.—Is best prepared by covering the bottom of a half-gallon bottle with a layer of copper oxide ½ inch deep, placing in the bottle a number of copper wires reaching from top to bottom, and filling the bottle with common hydrochloric acid of 1.10 sp. gr. The bottle is occasionally shaken and when the solution is nearly colorless, it is ready for use. Absorption capacity, 1 cc absorbs 1 cc of CO.

Sampling.

The taking of the sample of gas to be analyzed is of great importance. The location of the sampling nipple should be given careful consideration, as the gases at various points are often of varying composition. If a boiler setting were perfectly tight and no infiltration of air took place, the best results would be obtained by placing the nipple in the stack or flue at its smallest cross section. Usually by the time the gases reach this point they have been thoroughly mixed and an average sample can be obtained at any point. Owing to the possible leakage of air through a setting, it is best to take the sample near the furnace slightly beyond the point where the visible flame ends.

In return tubular, or water tube boilers with horizontal baffles, the same nipple should be inserted at the rear of the furnace, just before the gases enter the tubes, or the first pass. In the case of water tube boilers with vertical baffles, such as the Babcock & Wilcox, the sample tube should enter the setting at or near the top of the first pass near the baffles. Means should also be provided for inserting the sampling tube near the front header.

Whenever possible the sampling tube should enter through the side wall of the boiler setting, thereby enabling the collection of samples at different points across the furnace or pass.

By starting with the sampling tube at a point six inches in the pass taking a sample, then extending the tube one foot into the pass and taking another sample, and so on, until samples have been collected from the various points across the width of the pass or furnace, thereby averaging these, a correct composition of the gas is obtained.

Sampling Tubes.

Various types and arrangements of sampling tubes have been suggested and tried for securing at once an average sample, but it is hardly probable that a tube with various branches, a long slit or a number of small holes, will give a fair sample, since the velocity of the gases in the aspirating tube is such that most of the gas will be collected at the openings nearest the apparatus.

Tubing of Bohemian, combustion or Gena glass, or porcelain, should be used. For temperatures up to 1200° F. the glass tubing is preferable. The porcelain tube is used when the temperature of the gases is above 1200° F. or when gases are taken from the furnace. The latter tubing is expensive and brittle, therefore glass tubing should be used whenever possible. Metal tubes such as iron or brass pipe should never be used unless cooled, as the composition of the gaseous mixture is liable to change by their use, resulting in an increase of carbon dioxide. The shorter the rubber tubing connecting the sampling tube with the Orsat apparatus the better, as rubber has a tendency to absorb gas.

(To be continued.)

CONDENSERS FOR SMALL CENTRAL STATIONS.[1]

BY HARRY REMINGTON.

It is the purpose of this paper to set forth the effect of vacuum on the steam consumption of various types of prime movers and to discuss briefly the elementary facts of condensation.

The maximum efficiency possible for any heat engine is determined by dividing the difference between the absolute temperature at which the working fluid is received and the temperature of rejection by the temperature at which the fluid is received, from which it is evident that any lowering of the temperature of rejection greatly increases the efficiency of the heat motor. The curves of a diagram arranged to illustrate this, show graphically the theoretical increase in efficiency due to reducing the exhaust temperature and pressure.

It is seen that the higher vacuum employed, the greater is the increase of an ideal engine, for each inch in vacuum. Thus, while at 20-in. vacuum an in-

[1]Extract from paper read at Sixth Annual Convention Southwestern Electrical and Gas Association, Beaumont, Texas, May 14, 1910.

crease of vacuum to 21 in. adds only 3 per cent efficiency, the increase in efficiency resulting in increasing the vacuum from 28 to 29 in. is as much as 15 per cent. A glance at a steam table will at once explain this, for, while the drop in temperature of saturated steam from 20 to 21 in. vacuum is only 5 degrees F., the drop from 28 to 29 in. is 22 degrees F.; from another point of view, the pressure multiplied by the increase in volume of a pound of steam from 20 to 21 in. is 286 foot-pounds, while from 28 to 29 inches, it is 1137 foot-pounds. In the above and throughout this paper, unless otherwise stated, reference is made to a 30-inch barometer, that is, a 28-in. vacuum means an absolute vapor pressure of 2 in.

Certain types of prime movers are capable of utilizing low back pressure more than others. We can divide all heat engines working with steam into reciprocating engines and steam turbines. Reciprocating engines can in turn be divided according to the speed, the number and type of valves, and the number of cylinders. The economy to be derived from running condensing any of these various engines will in general depend on the steam saving in each case, the value of steam and the cost of vacuum.

The simple slide valve engine, subject to great losses due to wire drawing in the valve, large clearance spaces and considerable cylinder condensation, usually consumes from 30 to 50 pounds steam per brake horsepower when running non-condensing, depending upon the type of governor and the load. Even this engine, ill adapted as it is to derive benefits from reduced back pressure, shows considerable improvement.

The single expansion, slow speed, four-valve engine is more efficient and the table below shows how the economy of this type of engine is affected by the condenser. Roughly speaking, the steam consumption is reduced 25 per cent.

TABLE 1.—STEAM CONSUMPTION OF SINGLE CYLINDER FOUR-VALVE ENGINES.

Type		I.H.P.	Lbs. St. I.H.P. Hr.
	Non-Condensing		
Corliss, Jacketed	Peabody, Thermodynamics	237.0	21.5
Fleming	Prof. Carpenter, June 28, 1905, Cornell University	217.9	22.46
Fleming	Prof. Spangler, June 6, 1905, Univ. of Penn	132.0	22.24
Corliss	Peabody Thermodynamics	130.0	23.9
Corliss	Barrus, Engine Tests, P. 47	506.0	25.8
Corliss	Barrus, Engine Tests, P. 126	342.0	25.9
	Condensing.		
Corliss, Jacketed	Peabody Thermodynamics	155.0	16.5
Poppet Valves, Jacketed	Zeit, D. V. D. Ing. Aug., 1905, P. 1310	262.0	15.0
Gridiron Valves	Barrus, Engine Tests, P. 101	613.0	18.5
Corliss	Barrus, Engine Tests, P. 118	554.0	19.45
Slide Valve	Barrus, Engine Tests, P. 88	213.0	22.0
Corliss	Peabody, Thermodynamics	145.0	19.4

(Gebhardt's "Steam Power Plant Engineering.")

The compound engine with Corliss valves is of more general importance. The economy of using condensers with this type of engine is much greater than with simple engines. This arises from the fact that the exhaust valves open more widely, that there is a less range of temperature and hence less condensation in each cylinder, and, also because the ratio of expansion can be made greater. The results of a number of tests of compound engines, as reported in the various technical papers and proceedings are given in the following tables. The steam per horsepower hour decreases with the increasing size of the engine. Likewise, the economy derived from condensing apparatus increases as the engine size increases.

TABLE 2.—STEAM CONSUMPTION OF COMPOUND ENGINES.

Type	References	I.H.P.	Lbs. St. I.H.P. Hr.
	Non-condensing		
Williams	Peabody, Thermodynamics	39.6	19.2
Williams	Peabody, Thermodynamics	33.0	21.4
Ball, Chicago Public Library	Eng. Record, Aug. 6, 1908	187.5	21.14
Westinghouse Marine	Power, Aug., 1903	540.	19.3
Skinner, Cross Comp.	Power, July, 1906	375.	21.14
Buffalo, Tand. Comp.	Elec. World, May 23, 1903	121.	22.3
Reeves, Vert. Cross-Comp.	Eng. Record, July 1, 1905	185.0	20.0
Cross Comp., 4 - slide valves	Barrus, Engine Tests, Page 181	486.7	21.59
4-Cylinder Comp. Locomotive, No. 2512, Penn. System	Tests made at Louisiana Exp., 1904	495.0	18.6
	Condensing.		
Cross Comp. Corliss, Atlantic Mills Prov.	Amn. Elec. June, 1903	500.0	11.20
Leavitt Pumping Engine, Louisville, Ky.	Trans. A. S. M. E., Vol. 16, P. 169	648.0	12.20
Rice & Sargent Corliss, Amn. Sugar Refinery, Brooklyn	Trans. A. S. M. E., Vol. 24, P. 1274	627.0	12.10
Fleming Four Valve	Trans. A. S. M. E., Vol. 25, P. 212	348.0	12.13
Williams Vertical, N. Y. Navy Yard	Power, Oct. 1903, P. 583	340.0	12.60

(Gebhardt's "Steam Power Plant Engineering.")

Turning now to the steam turbine, we find that this type of heat motor, owing to the greater ratio of expansion and the fact that there is no alternate heating and cooling of metal surfaces to cause condensation within the turbine, derives the greatest benefit from condensing apparatus. In the turbine, the steam is allowed to expand completely to condenser pressure while doing work. The increase in economy of a 300 kilowatt Parsons turbine with increase in economy amounts to 40 per cent, corresponding to a reduction in steam consumption from 34.1 pounds to 21 pounds per kilowatt hour.

The lessened steam consumption due to operating under reduced back pressure is not the only important advantage to be derived from running condensing. Besides the saving in steam, which represents a coal saving, there is the increase in the capacity of the plant to be considered. With the same boiler equipment, we see that we can obtain more power per pound of steam when running condensing than when running non-condensing. Let us assume for instance, that a given equipment of boilers, engines, buildings, etc., cost $100.00 per horsepower, and that the size of the plant is 500 horsepower. By installing a condenser, the capacity of the plant could be readily increased to 625 horsepower, reducing the cost per horsepower, excluding for the present, the cost of the condenser, to $\frac{500 \times 100}{625}$ equals $80.00. Thus, there would be warranted an expenditure of about $20.00 per horsepower for condensers. This is many times the cost of a highly efficient surface condenser.

Principles of Condensation.

The condensation of steam can, for our present purpose, be considered as a very simple process. A pound of steam at a pressure of 1½ in. absolute, corresponding practically to 3 in. of mercury or 27 in. vacuum, referred to a 30-in. barometer, will occupy, as may be found in the steam tables, a volume of 231.8 cu. ft., and will have a temperature of 115 degrees F. If the steam is saturated, that is, in contact with water, the temperature will remain the same so long as the pressure remains unchanged.

If this steam pressure is maintained within a condenser that is receiving steam constantly from an engine or turbine, a volume and weight of steam must be condensed during each minute equal to the rate of inflow, otherwise the pressure and temperature of the steam within the condenser will be raised by compression. Now to condense one pound of steam at the pressure and temperature given requires the abstraction of 1027 b. t. u., the latent heat of the steam under these conditions.

As a pound of water will absorb one thermal unit when its temperature is raised 1 degree F., 51.4 pounds of water raised through a range of 20 degrees F. of temperature will therefore be required for each pound of steam condensed. Similarly 34.2 pounds raised 30 degrees F.; 25.7 pounds raised 40 degrees F., or 20.5 pounds raised 50 degrees F. may be used to perform the same duty. The temperature at which cooling or circulating water is received is usually fixed by the conditions and surroundings of the power plant. The temperature to which the water can be raised is limited by the temperature of the steam, and a perfect condenser would heat the circulating water to this temperature, and would require the theoretically minimum amount. Practically, however, there must be some difference in temperature between the steam and the water in order that the heat may flow from the steam to the water, as through the metal tubes of a surface condenser. In a jet condenser, where the steams comes into immediate actual contact with the water, conditions are different, and if through intermixture is secured the temperature of the water may be brought very close indeed to that of the steam.

Under the simple conditions above assumed, and assuming a perfect condenser, the vacuum is determined and solely by the temperature and amount of cooling water available. That is, if the amount of cooling water is so limited that it must be heated to 120 degrees F. in order to absorb all the heat of the steam, the best possible vacuum would be 26.56 in. If there is sufficient cooling water to absorb all the heat with a rise of temperature to 110 degrees F. the best obtainable vacuum would be 27.41 in., similarly for 100 degrees 28.07 in., and for 90 degrees, 28.58 in., for 80 degrees, 28.97 in., for 70 degrees, 29.26 in., and for 60 degrees, 29.48 in. A condenser based on these facts would consist then only of means of circulating the cooling water, of bringing the steam and water together and of removing the water resulting from the condensation of the steam.

In practice, however, the problem is much complicated by the entrance of another element, namely air, and it is the influence of air in the condenser that proves a stumbling block to many who attempt to understand the workings of a condenser.

The important fact to be kept in mind is Dalton's law of mixed vapors, which may be stated in this wise: "A constant weight of gas maintained at a constant temperature confined in a vessel of constant volume exerts the same pressure upon the walls of that vessel regardless and independently of any other gas or vapor present or introduced into the vessel."

Air and water vapor in a condenser obey this law of mixed gases. That is, if the temperature of the condenser is 101.5 degrees F., the pressure due to the water vapor in that condenser is exactly one pound per square inch. The total pressure in the condenser may be something quite different, as 1½ pounds per square inch, in which case the additional ½ pound must be due to the presence of some other vapor or gas, such as air.

The amount of air present is easily calculated from Boyle's and Mariotte's laws, namely, that at constant temperature the pressure of the gas varied inversely as its volume and that at constant volume the pressure varies directly as the temperature measured from the absolute zero, namely, 463 degrees F.. Combining the two laws we have the formula: $PV = RT$, in which if P is pounds per square inch, V cubic feet per pound of gas and T absolute degrees temperature, F. and the constant R 37.

With this explanation, let us return to the consideration of what goes on in the condenser. At the inlet opening we have a constant inflow of practically pure water vapor with only a very small, almost negligible percentage of air. This vapor, upon striking the cold circulating water rapidly condenses, becoming richer in air until, at the extreme part of the condenser we have a mixture of which air constitutes an important part.

How much water vapor and how much air there will be in a cubic foot of the mixture at this farthest point, which should be the location of the air pump suction, we can determine if we know the total pressure in the condenser and the temperature at the air pump suction. The pressure is practically uniform throughout the condenser. Let us suppose that it is 1½ pounds per square inch, as assumed above, then the temperature at the inlet where there is practically pure water vapor will be 115 degrees F. Assume that the temperature of the mixture at the air pump suction is 60 degrees F. From the steam table we readily determine the weight of a cubic foot of steam at 60 degrees F. .000828 pounds, and the pressure corresponding to 60 degrees F., or ¼ pound. Subtracting this from 1½ pounds, the total pressure, the best obtainable vocuum would be 27.07 in., and for we get the partial pressure of the air, and knowing its temperature and volume we obtain its weight. As a cubic foot of air at 60 degrees F. and 14.7 pounds per square inch pressure weighs .076 pound, we can calculate by means of the above formula, that each cubic foot of the mixture will then contain .00645 pound of air, and it will be seen that the air pump capacity required is determined solely by the number of pounds

of air entering the condenser per minute, and the temperature and pressure at which the mixture is withdrawn. As will be seen, a high vacuum is impossible without a cold air pump suction and a hot air pump necessarily implies a low vacuum.

ECONOMY IN LARGE TURBINE ELECTRIC PLANTS.

"The centering of power generation into a single generating plant for any large establishment is accomplished by economies in power generation," says Professor Dugald C. Jackson, the newly elected president of the American Institute of Electrical Engineers, "that are of themselves appreciable, besides contributing to reliability."

"Without the electrical distribution of the power," continues Professor Jackson, "such concentration could not be adequately carried out at all. Moreover, whatever limitations still exist toward improving the economy by completely concentrating the power generation in any industrial establishment, exist with respect to the prime movers and not with respect to the electrical distribution of the power. Where hydraulic prime movers are to be considered, the concentration may ordinarily be made as complete as the conditions of the water supply will permit, since the charges on account of first cost of installation and the labor cost of operating practically dominate the cost of the power developed, and these may ordinarily be expected to decrease per unit of output as the capacity of the plant is increased, under conditions of equal or improved load-factor. An equivalent condition has not heretofore existed where steam prime movers have been used. Since neither labor cost nor steam economy are much improved by increasing a steam-electric generating plant over a size of a few thousand kilowatts capacity when reciprocating engines are used, the need of extreme concentration of individual plants has not heretofore been acutely felt.

"But the advent of large steam turbines has altered the conditions. Plants equipped with these machines installed in association with boilers provided with adequate labor-saving appliances may be operated with labor costs that vie with the labor costs pertaining to hydraulic generating plants equipped with machines of equal size; and the steam economies derived from the newer steam turbines are remarkably satisfactory. The operating economies of large steam-turbine plants, either in respect to the use of labor or the use of fuel, do not however seem to be exhausted within the limits of capacity yet attained in even the largest generating plants now in commission. Moreover, the first cost per kilowatt of capacity of plant, including land, buildings, and machinery, falls off in an important degree for the larger steam turbine plants, until such a plant may nearly rival a hydroelectric plant in the gross cost per kilowatt-hour of energy delivered at the switchboard, through the fact that the fuel cost pertaining to the steam-turbine plant has an offset in the charges caused by larger first cost per kilowatt of capacity of hydraulic plant."

THE PLACE OF STEAM TURBINES.

Concerning the choice between steam turbines or piston engines for power in mill plants, Mr. F. W. Dean, of Boston, says in a recent paper:

There is no doubt that where electricity is to be used the turbine should be chosen. It is fully equal, if not superior, in economy to the piston engine. It requires less room, less foundation, less oil, the wear is almost nothing, and the fact that oil is not used in the steam renders it practicable to use condensed steam for feed water. This is of great advantage in bad water districts, and means freedom from boiler difficulties, and the absence of water purification devices.

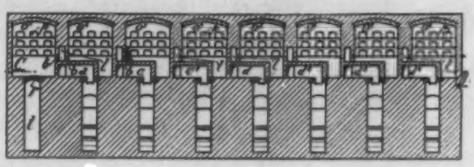
The turbine does not lend itself to belt driving, and in cases where electricity is not desirable the piston engine will hold its place. Such cases are mills where nearly all of the machinery operates simultaneously, as in textile mills, and in which there is an opportunity for simple direct drives by belts or ropes. In this case the cost of installation and of fuel is less than by any other combination. Where there are tools or machines that operate intermittently the electric system is advisable, and, in my opinion, direct current is to be preferred to alternating on account of the absence of power factor troubles. In many cases, however, it is not practicable to use direct current on account of the length of transmission. In some machine shops I have known the power factor to be as low as 60 per cent, which means that the generator will give only 60 per cent of the power that it would give if the power factor was 100 per cent, which it would be if it was carrying a lighting or an electrolytic load. The other 40 per cent takes the form of a wattless current which has no capacity to do work, and which vibrates back and forth between the generator and motors, having no effect except to heat the generator, wires and motors. The wattless current, I understand, does not consume or waste power, except the equivalent of the heat generated. In chocolate factories the power factor I have found to be about 70 per cent. In any factory where the load is intermittent the power factor will be low.

In regard to the reliability of turbines I know of a 500 k.w. turbine that has run 24 hours per day without stopping for 11 months. It was stopped for general examination and showed no sign of wear, nine cents were spent for repairs, and it was then started again. It then ran 14 months 24 hours per day without stopping and is now stopped for connection with a new switchboard. It will be examined, but the only known defect is slight leakage of a valve. Another turbine in the same house has made one run of three or four months and one of one month, both without stopping. It has not been used as much as the other because the other kept going.

In very large central power stations nothing but turbines should be given the slightest consideration for they are the cause of the wonderfully low cost of power for the reasons above stated, which appear in such cases in maximum form.

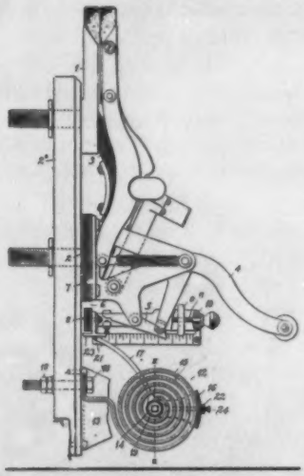
PATENTS

964,341. Method of utilizing Spent Fire-gases from a Furnace for Firing Further Furnaces. Hermann Uihlein, Nuremberg, Germany. The method of utilizing spent fire gases from a furnace for firing further furnaces, which consists in passing the spent fire gases from any furnace over glowing carbon of any kind at disposal charged into generators beneath following furnaces, so as to reduce their carbonic acid to carbonic oxid and to oxidize small quantities of the glowing car-



bon to carbonic oxid, in burning the regenerated gases with air for heating the respective furnaces, and repeating the process with the spent fire gases, so formed in the then following furnaces until the spent fire gases from the last furnaces are allowed to escape through a chimney, care being taken that the temperature of the glowing carbon does not sink beneath a determined limit, at which moment it is replaced b ya fresh charge of glowing carbon.

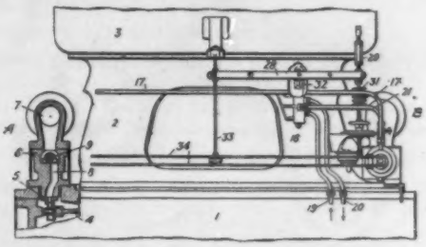
963,764. Electric-Circuit Interrupter. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. In a circuit interrupter, the combination with stationary and movable contact members, a latch for holding the members normally in engagement, and a tripping magnet for the latch having a movable core member, of



two double-strip current-conducting spirals having rigidly mounted outer ends and rigidly connected but jointly movable inner ends, a device for supporting the movable core member in its no-load position, and means for adjustably connecting said device to the inner ends of the spirals.

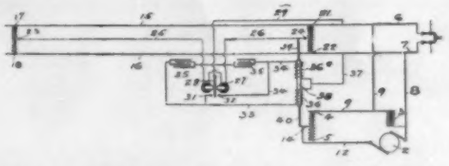
964,474. Manufacture of Incandescent Electric Lamps. Dennis Joseph O'Brien, San Francisco, Cal., assignor, by mesne assignments, to William P. Fairman, Philadelphia, Pa. The herein described process for the manufacture of electric tube-lamps which includes the following operations, viz: preparing the tube for the exhaust-pump; glanding the tube outwardly and laterally; inserting the filament in the open-ended tube and anchoring the ends of the filament to the glands; capping the glands and fitting both their caps and the outer ends of the anchors for connection in an electric circuit; pumping the air out of the tube and sealing the tube.

963,811. Governing Mechanism for Elastic-Fluid Turbines. Frederick Samuelson, Rugby, England, assignor to General Electric Company. An elastic fluid turbine mechanism for controlling the admission of motive fluid to the turbine wheel comprising a cylinder, means supplying lubricant under pressure to the turbine, a piston operating in said cylinder and



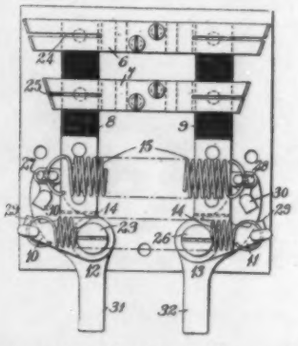
acted upon on one side by the pressure of the motive fluid supplied to the turbine and on the other side by fluid under pressure from said means, a pilot valve operated by the turbine governor for controlling the admission of fluid from said means to the cylinder and its exhaust therefrom, and a follow-up device for the pilot valve.

963,867. Electric-Control System. William M. Chubb, San Francisco, Cal. In an electric control system, a divided circuit, a resistance in each circuit, points of equal potential on the resistances, contacts on said points, a conductor connecting the contacts and electro-magnetic means in the con-



ductor operated by the movement of one contact to a point of different potential to cause a solenoid to be energized, an iron core in the solenoid connected with the other contact point and adapted to be moved by the solenoid to cause the contact point to move to a point of like potential.

963,735. Electric Switching Device. Christian Aalborg, Wilkinsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. In a switching device, the combination with a plurality of



sets of stationary contact terminals disposed in pairs in adjacent planes; of two spring-connected but independently movable contact-bearing switch arms adapted to electrically connect and disconnect said pairs of stationary contact terminals, and means for effecting a quick separation of each switch arm from the corresponding stationary contact terminals.

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Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Electrical Precipitation of Smoke

The smoke troubles of the power plant are small as compared with those of the smelter. Every week we read of some smelter that has been closed down because of alleged damage to surrounding vegetation from the sulphur dioxide resulting from the treatment of sulphide ores. Many attempts have been made to remove the sulphur from the smelter fumes, filtration through woolen bags being one of the most successful, especially at the plants around Salt Lake City.

A new process of electrical precipitation, devised by Dr. E. G. Cottrell of the University of California, was described by him at the San Francisco meeting of the American Chemical Society last week, the precipitation of suspended matter being accomplished by the discharge of a high voltage direct current. This phenomena is closely allied to the disruptive conduction of the Geissler tube which is used in the Moore light. Under the influence of this current the charged gas particles migrate to a lead plate where they are precipitated and finally recovered as dilute sulphuric acid. An alternating current is stepped up through a transformer to 40,000 volts and rectified by means of a synchronous motor, so adjusted that only the peak of the wave is utilized. The discontinuous direct current thus produced is discharged from an asbestos electrode suspended in the midst of the smoke, thereby removing the obnoxious gases.

In 1851 it was found that smoke could be cleared by a static electric discharge from a Leyden jar. In 1882, Sir Oliver Lodge gave a lecture on the electrical precipitation of fumes, his method being later patented for use with a Wimhurst machine. It lay dormant for over twenty years, until Dr. Cottrell, while investigating its application to the contact sulphuric acid process, realized its tremendous value to the smelters, which were then beginning to be shut down as public nuisances. His investigation showed that while an alternating current slowly agglomeratized the suspended matter, the best results were obtained with a high voltage direct current, giving a brush discharge. A roughened electrode, such as asbestos or micanite, from which the binding material has been removed, gives the best results, as there is a tendency towards an uneven point discharge.

The first commercial plant was installed at the Selby Smelter on San Francisco Bay. Another plant is now being put in to treat the fumes at the Balalakala smelter in Shasta County, California, which has been allowed to continue operations pending the completion of the electrostatic apparatus in October of this year.

As shown by Dr. Cottrell, the bag process, while well adapted to the treatment of blast furnace gases having a low content of sulphuric dioxide, is not so successful in treating the roaster and refinery fumes which are so strong as to soon destroy the woolen bags. The cost of the reinforced concrete bag houses is high and the electric power consumption for the blower is as great as that required by the electrostatic process.

PERSONALS.

C. L. Cory, electrical engineer, has been in Southern California.

A. M. Hunt has returned to San Francisco from the Santa Cruz Mountains.

Gifford Pinchot is making speeches in California in behalf of local "insurgent" politicians.

W. H. P. Hill, manager of the Monterey County Gas & Electric Company, is at San Francisco.

H. R. Noack, of Pierson, Roeding & Co., has returned to San Francisco from a visit to Quincy, Cal.

B. W. Collins, formerly sales manager of Parrott & Co.'s northwestern office, has been appointed city electrician at Tacoma, Wash.

J. A. Cranston, of Portland, who is interested in the Washington Water Power Company, of Spokane, arrived at San Francisco last week.

H. F. Way has been made general manager of the gas, water and electric interests of the Yakima-Pasco Water Power Company at North Yakima, Wash.

L. R. Pomeroy has been appointed chief engineer of the railway and industrial division of J. G. White & Company, incorporated, with headquarters in New York City.

E. C. Bradley, vice-president and general manager of the Pacific Telephone & Telegraph Company, with headquarters at San Francisco, returned from New York last Sunday.

J. H. Leary has become assistant manager of the Central California Traction Company, of Stockton. He was formerly a Southern Pacific chief train dispatcher under Division Superintendent J. D. Brennan.

Louis McKissick, assistant general superintendent of the Western division of the Western Union Telegraph Company, and formerly wire chief in the San Francisco office, has been appointed general superintendent of the company's newly created "Gulf" division.

J. C. Murray, sales engineer with the Kellogg Switchboard & Supply Company has left on a six months business extension trip in South America, stopping at Bahai, Rio de Janeiro, Sao, Paulo, Montevideo, Buenos Ayres, Santiago, Lima, Colon and other cities.

O. F. Metz has joined the staff of W. S. Heger, Pacific Coast manager of the Allis-Chalmers Company, as office engineer, with headquarters at San Francisco. He has been connected with the Northern division of the Pacific Gas & Electric Company recently, but was for some years formerly with the Allis-Chalmers Company.

L. W. Storrer, who was for many years Pacific Coast manager of the Postal Telegraph Company, and had been acting in an advisory character during the past year, severed his connection with the corporation this month, taking charge of the telegraph department of the Pacific Telephone & Telegraph Company, with headquarters in San Francisco.

Ely C. Hutchinson has returned to the Pelton Water Wheel Company's San Francisco office after visiting the Northwest where he secured a contract for a large Pelton-Francis turbine water wheel to be installed at a hydroelectric plant in Idaho. The electric equipment including that of the power house and apparatus for two sub-stations was awarded to the General Electric Company.

C. E. Sloan, of the engineering firm of Spalding, Sloan & Robson, returned to San Francisco last week after completing a seven-mile sewer system at Newman, Cal. The same firm also had charge of the construction of a novel waterworks plant, which has been in operation a short time. The triplex pump can be operated either by gasoline or electric power and steam power can be utilized in emergency.

FUEL INVESTIGATIONS BY BUREAU OF MINES.

The act establishing a Bureau of Mines in the Department of the Interior, approved May 16, 1910, became effective July 1. As originally approved, the law contemplated the transfer of the entire Technoligic Branch of the United States Geological Survey, the mine accident investigations, fuel investigations, structural materials investigations, the entire personnel, property and equipment, to the Bureau of Mines, but the Sundry Civil appropriation act approved June 25, amended the law to such an extent that the structural materials investigations, including the personnel and equipment for these investigations went to the Bureau of Standards, Department of Commerce and Labor.

The fuel investigations under the Geological Survey and which are transferred to the Bureau of Mines have already resulted in a better realization throughout the country as to the value of fuels. One result of this work is that nearly all of the fuel now purchased by the federal government is bought on specifications and subject to test by the Fuel division, or purchased after examination made of the coal supplied by the mines from which coal is delivered to the government.

For the analyzing and testing of the coals, lignites, ores, and other mineral fuel substances belonging to or for the use of the United States, $100,000 was appropriated. Of this amount, $35,000 will be spent in the chemical and physical investigation of fuels; $25,000 in the inspection of government fuel purchase; $22,000 in fuel efficiency investigations; $5,000 in lignite and peat investigations; and $4,000 in briquetting investigations.

The publications of the Survey relating to mine and fuel investigations, those prepared by the Technologic Branch, will in the future be distributed by the Bureau of Mines. The publications relating to structural materials will continue to be distributed by the Geological Survey. The last of the bulletins of the Technologic Branch to be published by the Survey will be issued from the Government Printing Office about August 1. This bulletin relates to the Explosibility of Coal Dust and was prepared by G. S. Rice, with chapters by J. C. Frazer, Axel Larsen, Frank Haas, and Carl Scholz.

The first of the Bureau of Mines bulletins, the Volatile Matter of Coal, by H. C. Porter and F. K. Ovitz, will be published in the next few months. Then will follow Coal Analyses, by N. W. Lord and J. S. Burrows; Final Data Regarding Steam Tests, by L. P. Breckenridge; North Dakota Lignite as a Boiler Fuel, by D. T. Randall and Henry Kreisinger; Producer-gas Tests in 1905-1907, by R. H. Fernald; The Coke Industry as Related to the Foundry, by Richard Moldenke; Coals for Illuminating Gas, by A. H. White and Perry Barker; and Petroleum for Combustion under Steam Boilers, by I. C. Allen.

CALIFORNIA NO. 2, N. A. S. E.

Newly installed officers of California No. 2, National Association of Stationary Engineers at Los Angeles, are: President, A. M. Woods; Vice-President, J. E. Mackey; Treasurer, Fred Fischer; Recording Secretary, John Topham; Corresponding Secretary, C. G. Bailie; Conductor, H. J. Thompson; Doorkeeper, W. E. Lynam.

N. A. S. E. SMOKER.

California No. 1, N. A. S. E., entertained a large number of the stationary engineers of San Francisco at a smoker and high jinks on July 14, at the association's headquarters on Golden Gate avenue. The program included songs, stories and dances by vaudeville talent and a number of boxing bouts. Supper was served during the performance, after which a number of speeches were given, thus concluding a most enjoyable entertainment which was greatly appreciated by all present.

INDUSTRIAL

NEW HEATING DEVICES.

The General Electric Company early realized that the success of heating devices would depend largely on the superior qualities of the resister or heating element, and the supervision of its manufacture. Expert metallurgists mixed in their crucibles hundreds of combinations of metals and the discovery of a new alloy which was named "Calorite" resulted. This alloy is ideal in its characteristics for this service. It has a high resistance, a high melting point and is non-oxidizing. It is ductile and malleable but is not brittle. The design of the heating element is based on a careful consideration of thermal conductivity, conviction and radiation, also of electrical and thermal insulation, of resultant temperature, and of heat storage. The use of these heating elements in all their designs ensures that the G-E heating devices shall possess superior features.

Leaf Unit Electric Flatiron.

This iron embodies all the essential features of an ideal iron, being the result of a systematic study of the requirements and the gradual evolution of a design which fulfills them. It is well suited for light, medium and heavy laundry purposes and so will give excellent satisfaction in both domestic and commercial work. It is provided with a leaf heating unit which is spread over a broad path around the edges of the bottom surface so that the heat is delivered most directly to the parts of the iron which first come in contact with the damp material.

Fig. 1. Eight-lb. Leaf Unit Flat-Iron.

Rapid heating and ample heat storage have been combined in proper proportions to make an efficient iron. Three standard forms of connection are provided, the plain attachment plug, the indicating switch plug, and the permanently attached cord. With light or medium work it is advantageous to control the heat regulation by turning the current on or off as required, depending upon the nature of the work. This may be most readily accomplished by means of the indicating switch attachment plug. For very wet or heavy goods, it is generally necessary to keep the current on continuously. The plain attachment plug may be used where there is an occasional demand for continuous heat, as in the ordinary household. The flatiron with the permanently attached cord is especially recommended for laundries and similar establishments where controlling switches and pilot lamps are located conveniently near the ironing board.

The electric flatiron is made for one heat only. Wherever heat regulation is required it may be obtained by turning the current on or off from time to time as previously referred to. About three minutes are required for the iron to heat up sufficiently for light work. These irons may be attached to any lighting circuit, either a. c. or d. c., where the pressure does not exceed 125 volts and consume 650 watts.

Electric Sealing Wax Heater.

This device is designed for use in express offices, banks, shipping departments, stores, and business establishments of all kinds where sealing wax is used for making seals, sealing packages, etc. It is fitted with a removable sheet metal cover, the surface of which slopes downward to a center hole which provides access to the melted sealing wax. This feature of design also allows all drippings to drain back into the pot. This type of heater is most useful for continuous service where large quantities of sealing wax are required.

Fig. 2. Sealing Wax Heater.

It has a maximum capacity of 3 lb., and is arranged for three degrees of heat control, "Off," "Low," "Medium," and "High" points, consuming 65, 100, and 200 watts respectively. The maximum heat is used for quick heating and the minimum heat then maintains a constant operating temperature.

Electric Celluloid Heater.

During the last few years, the manufacture of celluloid articles has attained great importance, due to the extended use of this material for personal, domestic, ornamental, office and industrial purposes. Since it is moulded while hot, the necessity of constant and exact temperatures is imperative in order to avoid accidents because of its inflammable nature. These requirements are well fulfilled by the 16 x 30 in. electric celluloid heater. By the use of this device the product

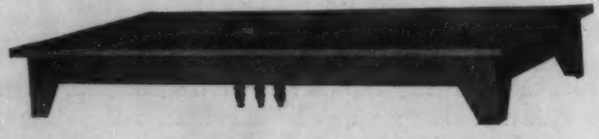


Fig. 3. Electric Celluloid Heater.

is made uniform in quality as the same degree of heat is always produced and the work can be duplicated without variation. It is portable and can be easily installed wherever convenient. The heat is instantly available and readily controlled. It replaces high pressure steam with its attendant danger of explosions, leaky pipes, and transmission heat losses.

The standard electric celluloid heaters are available for operation on 100, 110, 120 and 240 volt circuits. They have three degrees of heat regulation, consuming 90, 225, and 450 watts respectively. The maximum heat is used for quick heating as it requires only about 10 minutes to attain the proper temperature. The minimum heat then maintains a constant operating temperature of 150-165 degrees F.

Electric Soldering Pot.

A great advantage of this device is its elimination of the use of coal, gas, gasolene, oil and other dangerous and unhealthful heat producers. It is clean, sanitary, without odor or fire risk, and very convenient. The heat is very easily regulated so as to maintain the molten metal at the proper temperature for best results. It finds extensive application, being suitable for melting lead, solder, babbitt metal, for tinning, dipping, and soldering wires and other small articles, for telephone manufacturing establishments, electrical repair shops, etc.

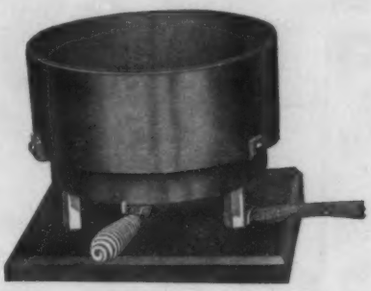


Fig. 4. Electric Soldering Pot.

In construction it is a shallow circular vessel of cast iron, the cup being assembled on top of the heating disc. The heating unit is readily accessible. There are three degrees of heat regulation, consuming 200, 400 and 600 watts respectively. This device is designed for attaching to electric circuits where the potentials are 100, 110 or 120 by standard attaching plug.

Oil Tempering Bath.

In the present age of large manufacturing plants equipped with high speed tools, the cutting steel must be uniform and reliable. This requires the use of hardening and tempering processes which produce absolutely reliable results. The tempering process involves two steps, hardening and drawing. The first step consists in heating the steel to a temperature of from 600 degrees to 700 degrees C., depending on the amount of carbon in the steel, and then chilling it by plunging it into a cold bath. The temper of the tool is then

Fig. 5. Electrically Heated Oil Tempering Bath.

"drawn" by heating it to a certain predetermined temperature, after which it is allowed to cool gradually. It has been customary for the workmen to judge this temperature by the color assumed by the metal. This introduced the liability to error of judgment on the part of workmen. Realizing the shortcomings of this process, the General Electric Company has designed a device which eliminates this uncertainty and ensures absolute uniformity in tempering. The steel is suspended in an oil bath, which is provided with a thermometer of precision for registering the temperature. The workman is supplied with a table of temperatures corresponding to certain degrees of hardness in the steel. He places the steel in the bath, brings the latter to the required temperature and maintains it as long as necessary. The device allows one person to temper a larger quantity of steel than is possible by other methods.

Electric Soldering Irons.

The advantages of electrically heated devices are well illustrated by this device. The operation of ordinary soldering irons is expensive and inconvenient, as it involves the intermittent use of gas and sometimes compressed air, and the expense and trouble are also increased by delays, due to continual reheating, waste heat, and frequent necessary renewals. With gas it is impossible to keep the iron at the correct temperature continuously; moreover fumes from escaping gas are of frequent occurrence and a menace, as they vitiate the

Fig. 7. Soldering Irons Without Guard Rings.

atmosphere and induce fire risk. It is exceedingly difficult to maintain a proper soldering heat outdoors and there are many places which are so confined or so difficult of access that it is almost impossible to use the gas or torch heated tools.

All the above disadvantages are eliminated by the use of electric soldering irons. They are economical, convenient, and reliable, heat quickly, are easily regulated and maintain a constant and uniform temperature. All the heat is generated in the tip where it is available for work. They require

Fig. 8. Soldering Iron With Guard Ring.

only a small current and little attention. There is no accumulation of soot or burning off of the tin at the tip. Being furnished with flexible connectors, they are handy and portable. Work is therefore improved in quality and increased in quantity where the electrically heated irons are used. The irons of the different sizes consume 75, 100, 150, 225 and 325 watts respectively.

Six Slice Toaster.

This toaster has been designed especially for hotels and restaurants. The heating units consist of vertical coils such as are used in the two-slice toasters, and the toasting is similarly accomplished by means of radiant heat. The maximum temperature is almost instantly available after the current is turned on. It is not necessary to turn the slices of bread as the heat acts upon both sides of each slice at the same time,

accomplishing the toasting of all simultaneously. The advantages of the radiant toaster in producing crisp, brown toast are too well known to need further mention. It has a maximum capacity of six slices, each slice being placed in a hinged wire rack, which is located between two rows of heating units. There are thus seven rows of heating units, each row consisting of four vertical heating elements and consuming 500 watts. These are in two sections of three and four

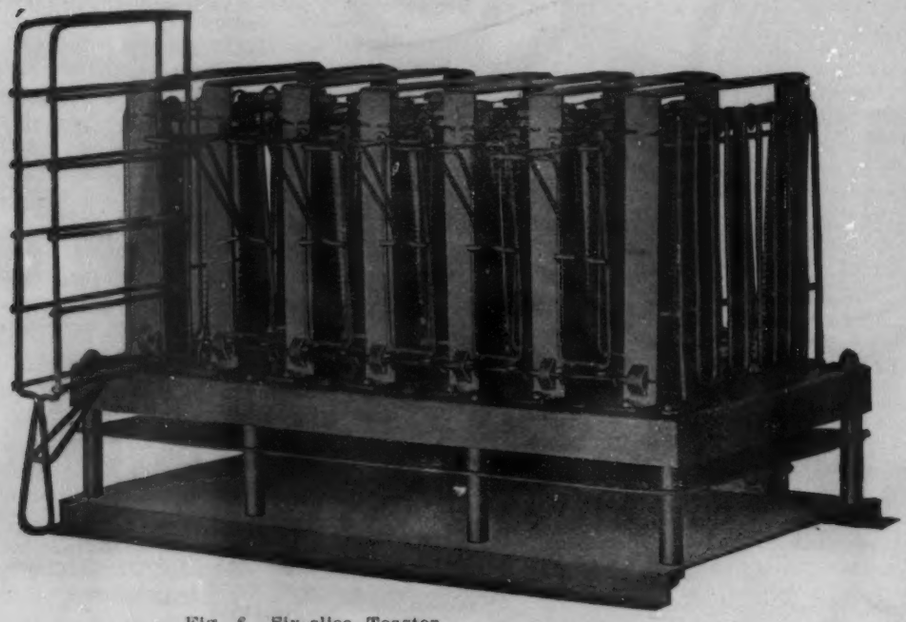


Fig. 6. Six-slice Toaster.

rows each, either section of which may be operated alone or in conjunction with the other, so that 2, 3 or 6 slices may be made at the same time. This instantaneous toaster will be a welcome addition to the kitchen equipment of hotels and restaurants, as it permits toast to be made as fast as one can put in and take out the slices. The use of this device enables the chef to make 6 slices of toast per minute and eliminates the annoyance and expense of maintaining fires to supply an occasional demand for toast. It is designed for attachment to lighting circuit by an indicating snap switch. Each toast rack has a wire handle projecting from the top edge which, when depressed, swings the rack upward and out from between the units.

TRADE NOTES.

The Pacific States Electric Company have opened an office and store at 90-92 Seventh street, Portland, Ore., with a complete stock of electrical supplies, instruments and apparatus.

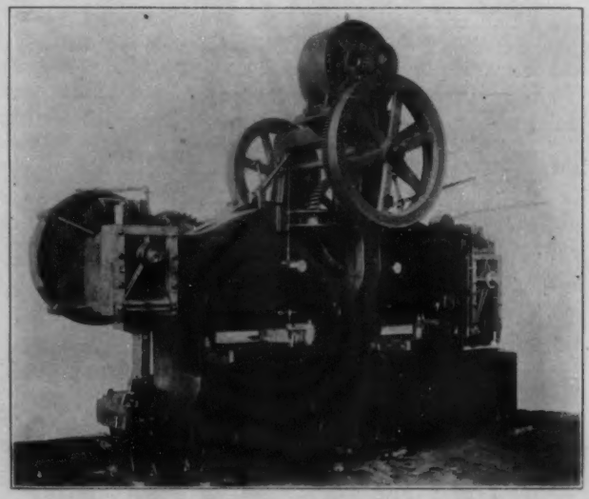
M. P. Schell Manufacturing Company, machinery manufacturers, formerly at 1759 Union street, have moved to 509-11 Howard street, San Francisco. The firm makes all kinds of special machinery and instruments for electric and steam power plants and engineers.

The electric equipment for the Natomas Consolidated No. 8 dredge, the largest gold dredge in the world, has just arrived at Natoma, near Folsom, Cal. This includes over 1000 h.p. in various Westinghouse Type H.F. variable speed and Type C.C.L. constant speed motors, together with switchboard and transformers, all manufactured by the Westinghouse Electric and Manufacturing Company. The buckets on the dredge have the large capacity of 13½ cu. ft. each. The dredge is expected to be in operation next September near Folsom.

UNIVERSAL SHEARS FOR CHANNELS, ANGLES AND PLATES.

The accompanying illustration shows a motor driven universal shear for squaring and mitering channels, angles and plates, used in structural steel work. This machine was built especially for the Marine Department of the Maryland Steel Company, Sparrows Point, Maryland, but would be found very useful in any iron works where steel forms must be cut for construction work. This machine has a coping attachment at one end, a plate shear at the other and two intermediate 45-degree angle shears. The coping attachment can also be used as a punch. The plate shear will cut angles up to 6 in. by 6 in. by 1 in. or 8 in. by 8 in. by ¾ in. and channels up to 15 in. by ¾ in. Each shear is controlled by its own clutch, and the machine can be operated simultaneously by three groups of men without interefering with one another.

The frames, plungers, pendulums, clutches, and all parts subjected to severe shock are semi-steel castings. The shafts are made from hammered steel containing from .4 to .5 of one per cent carbon. The gears are provided with long hubs which extend through the gear casings. Particular attention has been given to obtaining satisfactory lubrication for all bearings. An especially designed automatic stop motion on each shear throws out the clutch when the shear reaches the highest point of its travel, while a similar automatic stop on the coping device is adjustable, thus allowing the plunger



Universal Shears for Channels, Angles and Plates.

to be stopped at any predetermined point in its downward stroke.

The net weight of this machine is approximately 23 tons and it is designed throughout for long life under most severe service. It is built by the Covington Machine Company of Covington, Va., and is equipped with a 25-h.p. type S direct current motor manufactured by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

WITT AUTOMATIC FEED WATER REGULATOR AND OIL BURNER GOVERNOR.

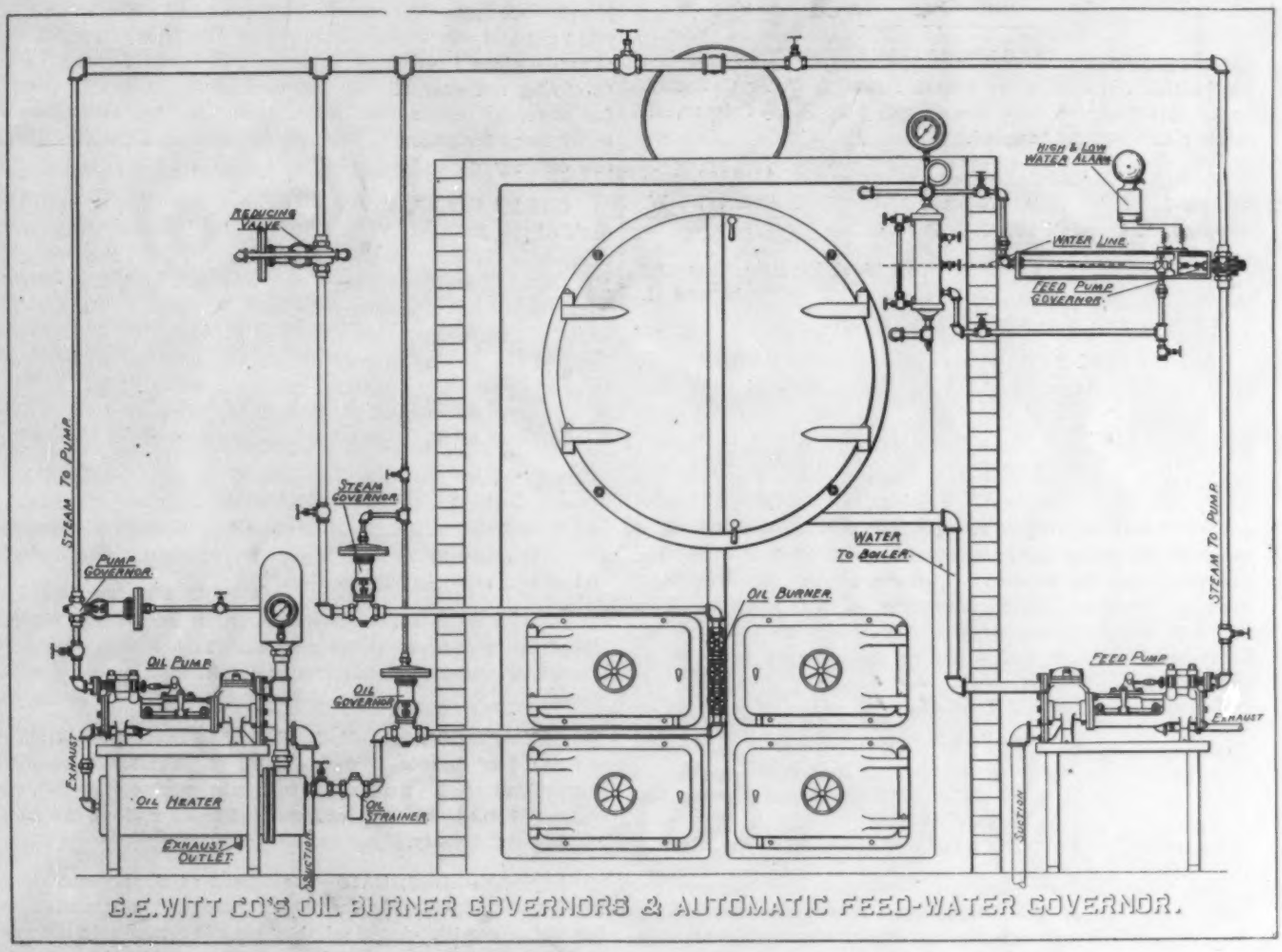
The accompanying illustration shows the G. E. Witt Company's automatic oil burner governors and boiler feed water regulator. The most essential thing in the operation of a steam boiler is the close regulation of the feed water and the constant steam pressure, which is almost impossible to accomplish by hand regulation. The advantages of automatic regulation include a great saving of fuel and labor, increase in capacity of the plant and fewer repairs on the furnace and boiler.

This boiler feed regulator is operated by expansion and contraction. This device is simple in construction and has but one wearing part entirely external to the boiler, the expansion member consisting of a brass tube placed in a frame and located on a level with the desired water level in the boiler, one end of the tube being connected to the tube of column. As the water rises in the boiler it also rises in the tube, causing it to contract. This closes the valve and slows down the boiler feed pump which causes the water to recede in the boiler and tube until the steam enters the tube, which causes the same to expand and open the valve to the feed pump. The brass tube in this regulator being placed on a level, it requires but slight movement of the water to operate the valve. This feature insures a close regulation of the water.

The automatic oil burner regulation consists of two governors and one reducing valve, a reducing valve and one governor being placed on the steam pipe to the burner and one governor on the oil pipe leading to the burner. The oil the water column and the other end to the lower end of the and steam governors are set at the desired boiled pressure, the diaphragm being connected to the drum or main steam pipe of the boiler. As the load increases on the boiler, the steam pressure will decrease, thus causing the governors to open and increase the flow of oil and steam to the burner. Should the load decrease, the boiler pressure will rise, causing the governors to close the flow of oil and steam to the burner. The reducing valve is used in order to get a reduced pressure which is more economical and noiseless.

TRADE NOTES.

The Robinson Manufacturing Company of Everett, Wash., has placed an order with Allis-Chalmers Company for a 155 k.w., 900 r.p.m., 60 cycle, 3-phase, 480-volt alternator, one 60 h.p., one 40 h.p. and one 20 h.p. squirrel cage induction motors. These will be installed in a new plant which the company is now constructing.



Allis-Chalmers Company recently sold a turbine to the Standard American Dredging Company of San Francisco. This company is one of the largest dredging concerns in the United States and has many boats on the Pacific Coast and on the Gulf. The turbine, which is a standard 500 k.w., 2300-volt, 3-phase, 60-cycle, 3600 r.p.m. machine, will be installed on one of its largest dredges and will furnish power for driving a 500 h.p. motor direct connected to the dredge pump. The alternator will receive exciting current from a 15 k.w. Allis-Chalmers generator direct connected to an American Blower Company's engine. Steam will be supplied at 175 lbs. pressure and 100° F. superheat.

NEWS NOTES

FINANCIAL.

KENDRICK, IDAHO.—A special election will be held in Kendrick, Idaho, by electors for the purpose of bonding the town in the sum of $10,000 for the purpose of maintaining a system of waterworks.

SANTA BARBARA, CAL.—A resolution of intention to call a bond election for $200,000 water bonds has been adopted by the City Council in accordance with previous recommendation of the water commisisoners.

ASHLAND, ORE.—The city election held for the purpose of voting on two bond issues resulted in carrying both propositions, one of which was the proposition of bonding for $25,000 for the completion of the electric light and power plant.

INCORPORATIONS.

ADRIAN, WASH.—The Adrian Power & Water Company, capital, $457,000, has been incorporated by E. P. Colman, H. Lessing and H. W. Mangoad.

LOS ANGELES, CAL.—Devore Water Co., $310,000, subscribed, $1000, by T. S. Wadsworth, C. W. Hollister, W. W. Brown, J. A. Crandell and S. J. Parsons.

SAN FRANCISCO, CAL.—The Ideal Electric Company has been incorporated by M. B. J. Gerke, F. L. Gerke and H. F. Sullivan, with a capital stock of $10,000.

SALT LAKE CITY, UTAH.—The Electric Railway Company has been incorporated by business men of this city, with a capital stock of $1,500,000. The purpose of the company is to build and operate an electric railway from Salt Lake City to Utah county points. Construction work will begin this summer.

PRINEVILLE, ORE.—A. company of Prineville men composed of W. A. Booth, president; Warren Brown, secretary-treasurer, and D. Stewart, G. Cornett and W. Brown as board of directors, has filed articles of incorporation. The company will generate electric power for operation of all kinds of machinery, and will own and operate grist mills. The principal office is at Prineville; capital stock $50,000. The location of the plant of the new company will be at Cove Orchard on Crooked river. Six thousand horsepower will be developed.

TRANSMISSION.

GROVELAND, CAL.—Manager Graham of the Good Ship Mines, is preparing to install an electric power plant here at once.

TACOMA, WASH.—Light and Water Commissioner Lawson announced that no bids were received for the construction of the $95,000 sub-station of the Nisqually power plant.

NEW WESTMINSTER, B. C.—The Vulcan Boiler Works of this place has secured the contract for the construction of two miles of pipe for the Vancouver Island Power Company's projected plant at Jordan river, on the island.

PLACERVILLE, CAL.—Notice of an appropriation of 50,000 inches of the water of the Rubicon river has been filed with the county recorder by H. H. Baker. The water will be diverted at a point on the river about a quarter of a mile below what is known locally as Grasshopper bar. The purpose of location is for the generation of electricity for the operation of railroads.

NEW WESTMINSTER, B. C.—The Canada Power Company of Stave Falls is considering the proposition of putting in transmission wires from the falls to Pitt river, thereby furnishing light to the towns of Haney, Hammond and other points.

LEWISTON, IDAHO.—It is reported that the Lewiston Clarkston Investment Company has closed a contract with the Washington Water Power Company of Spokane for the electric current to be received at Moscow on a new transmission line to be constructed from Palouse to Moscow to conect there with the Lewiston system.

SPOKANE, WASH.—J. L. Harper, representing the North Washington Company, has closed a 10-year lease for the Similkameen power plant, near Oroville, Wash. The North Washington Company, which owns and operates an electric light and power plant at Republic, Wash., will develop the Oroville plant itself to a point where it will be capable of supplying not only all the demands of the Republic district for power by means of a transmission line, but also those of many large irrigation enterprises in Okanogan County, which are entirely dependent on it.

GREAT FALLS, MONT.—The first two units of 6000 h.p. each of the Rainbow Falls development at Great Falls, Montana, have recently been successfully started. According to Mr. Chas. T. Main, of Boston, the engineer in charge of this work, the other four units of 6000 h.p. each in this development will be in operation sometime in August. The Rainbow Falls is the second largest of the five falls in the Missouri river at Great Falls, Montana, having a fall of 54 feet. There is an aggregate drop of 433 feet in the Missouri river within 5 miles, with a total possible development of about 330,000 h.p.

ILLUMINATION.

WILSON CREEK, WASH.—The City Council has granted a 50-year franchise to C. J. Weller to operate an electric light and power plant in Wilson Creek.

SANTA ANA, CAL.—The unincorporated town of Garden Grove has petitioned the Supervisors to call a special election of the town to vote upon maintaining a street lighting system.

OLYMPIA, WASH.—H. H. Hyde has made application to the Board of County Commissioners of Thurston County for a franchise to construct and maintain a pipe line for conducting of gas to be used for light and heating along the roads of Thurston County.

LOS ANGELES, CAL.—The Board of Supervisors is receiving sealed bids for furnishing necessary equipment and for lighting with electric lights certain streets in Downey Lighting District in accordance with specifications on file with the Board of Supervisors.

SAN FRANCISCO, CAL.—Sealed bids will be received by the Board of Public Works in the David Hewes Building, 995 Market street, San Francisco, between the hour of 10 and 11 a. m. on Friday, July 29, 1910, for doing the electric work of the Burnett School Building.

LINCOLN, CAL.—C. E. Young, superintendent of the Marysville division of the Pacific Gas & Electric Company, has been looking over the local situation with a view to improving the general lighting service in Lincoln. The system will be practically rebuilt and in a short time day service will be installed.

COLFAX, WASH.—President Henry M. Richards of the Washington Water Power Company, has made several liberal offers relative to the street lighting and the water system of Colfax, and agreed to give the city light, remodeling the whole system, at less cost than heretofore.

LOS ANGELES, CAL.—The Stacey Manufacturing Company of St. Louis has sent its representative, Mr. C. H. Gleeson, with several men, to Santa Barbara, to erect the new gas plant of the Santa Barbara Gas & Electric Company. The foundations have all been placed under the direction of the local manager, and work will proceed rapidly.

SAN FRANCISCO.—The Pacific States Electric Co. and other creditors of the Light Store of Oakland, have brought an involuntary action in bankruptcy against the firm in the United States district court. It is alleged that the firm committed an act of bankruptcy on the ninth of the month, by admitting that it could not meet its financial obligations.

MANILA, P. I.—Mr. Patrick J. Moore, formerly a lawyer of this city but now practicing in Zamboanga, is in Manila at present on his return to Mindanao. Mr. Moore came to this city on business connected with the securing of a franchise for a water and heat, light and power plant for the city of Zamboanga. The franchise has been approved by the municipal council and now awaits the approval of the Commission.

SAN FRANCISCO, CAL.—U. S. District Judge Van Fleet, sitting in the Circuit Court has continued the hearing in the matter of the order to show cause, issued against the city at the instance of the Metropolitan Light and Power Company, until September 5. It was agreed also that instead of putting up an indemnity bond, the gas company should impound the excess collected by it over and above the rate fixed by the Supervisors, which forms the basis of the suit.

TRANSPORTATION.

CORONA, CAL.—It is reported that the Pacific Electric Railway Company will soon begin work on another 12-mile extension toward Riverside and that the road will be in Corona by January 1, 1911.

GLENDALE, CAL.—The residents of Monte Vista and Sunland are trying to form a combination with citizens of Crecenta to raise a sufficient bonus to induce E. D. Goode of Glendale and the Eagle Rock Railway Company to extend that line to their respective towns.

CITY OF MEXICO.—All but one block of the first half of the general hospital electric line running south from Avenida de Chapultepec to the hospital, has been completed. Work will then begin on the loop, which will bring the cars in that service back to the city by the way of Calle de Jose M. Vertiz.

NORTH YAKIMA, WASH.—President N. C. Richards of the Yakima Valley Transportation Company has arranged for installing $20,000 worth of machinery at its yards. The building will be of stone and cost $10,000. It is announced that the company expects to build and operate seven city electric lines.

PORTERVILLE, CAL.—An ordinance has been passed granting to F. U. Nofziger, associates and assigns for the term of 50 years from the first day of July, 1910, a franchise to lay and maintain railroad tracks and to pass with and operate a steam or other motive power railroad along certain streets and portions of streets in this city.

ALBUQUERQUE, N. M.—Actual construction of the new trolley line to Highland is now finished and all that remains is to place cars upon it. The Board of directors has met and discussed financial matters authorizing Secretary Barth of that board to go to Denver to conclude a deal for the placing of the bonds of the company. The Western Securities Company of Los Angeles is the company with which negotiations are under way.

WATERWORKS.

MODESTO, CAL.—The city clerk has been authorized to purchase 800 feet of 2-inch water pipe.

VALLEJO, CAL.—The United States Pipe Company has been awarded the contract for furnishing 2000 feet of 4-inch water pipe to the city.

BISHOP, CAL.—The Trustees have awarded to Leece & Watters for about $585, a contract for furnishing 1000 feet of 4-inch pipe on standard hydrants, etc.

DAVIS, CAL.—Mr. Van Zandt, a representative of the Pacific Gas & Electric Company, has obtained a sufficient number of signers for water and probably the company will install a system here.

TACOMA, WASH.—The council has passed a resolution providing for the construction of a 6-inch cast iron water main in Melrose street and South Fifteenth street from Junett street, to Cedar street and on Cedar street from South Fifteenth to South Fourteenth streets.

LOS ANGELES, CAL.—The Council has referred the communication of the Civic Association of Pasadena relative to securing the Owens river water for Pasadena, to the water commissioner. Mayor Alexander has requested that immediate attention be given to the proposition of supplying outside municipalities with surplus water when the aqueduct is completed.

LOS ANGELES, CAL.—Underground watering of Central Park is to be tried by the park board. The commission has passed on a pipe system by which Central Park is to be underlaid with 2-inch pipes with spray outlets at close intervals throughout the park. If the experiment is successful the system will be installed in other parks. Central Park, it is predicted, can be watered in 30 minutes by the new system.

SEBASTOPOL, CAL.—The population of Sebastopol has grown to such an extent during the past two years that it is necessary to increase the supply of public water. The present water system consists of a large well and a 212,000 gallon reservoir, in addition to a spring which is situated several hundred feet from the well. There are great possibilities for development in the spring and the Trustees will take the matter up at once.

LOS ANGELES, CAL.—With $2,235,000 at hand to fill the depleted treasury immediately and meet all expenditures between now and December 1st, when the next bond installment will be purchased under option, the Owens river aqueduct can again be pushed forward. The aqueduct work faced a financial crisis several weeks ago. The New York bond syndicate, which took an option on the entire bond issue of $25,000,000, found that the work was progressing so rapidly that it required bond purchasers with greater frequency than the Eastern financiers cared to buy. The crisis became so acute that the Mayor sent a special message to the Council urging that immediate steps be taken to meet the emergency. A committee was appointed. The banks were appealed to. All responded with offers to buy as much as needed. Two Eastern insurance companies purchased $1,000,000 worth of the bonds. More were taken by local institutions and the rest of the money was raised by selling the bonds to the city itself, employing part of the sinking fund provided to retire the bonds.

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